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**Exploration and Geological Services Division, Yukon Region**

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# YUKON GEOSCIENCE
## Looking to the next millenium

Results of the second Yukon Geoscience Planning Workshop
March 29-30, 1999, Whitehorse, Yukon

Canada

YUKON GEOLOGY PROGRAM

Yukon Government

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Exploration and Geological Services Division, Yukon Region

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Results of the second Yukon Geoscience Planning Workshop
March 29-30, 1999, Whitehorse, Yukon

Edited by
J.G. Abbott and D.S. Emond

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*Front cover photograph by Maurice Colpron*

Workshop participants (from left to right): Mike McDougall, Rob Carne, Jim Christie, Rob Shives, Lynn Anglin, Julie Hunt, Jeff Bond, Ken Galambos, Paul Price, Grant Abbott, Larry Lane, Jim Mortensen, Moira Smith, Bill LeBarge, Gerry Carlson, Craig Hart, Grant Lowey, Tim Bird, Sandy Colvine, Suzanne Paradis, Steve Gordey, Derek Rhodes, Don Murphy, Lionel Jackson, Jean Pautler, Shirley Abercrombie, Lee Pigage, Carl Schulze, Stephen Johnston, Robert Stroshein, Mike Burke, Roger Hulstein, Dennis Oulette, Steve Morison.

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# EXECUTIVE SUMMARY

Four years after the first Yukon Geoscience Planning Workshop (the Marsh Lake Workshop, March, 1995), forty two representatives of industry, academia, and government (Table 1) met at the High Country Inn in Whitehorse to re-examine the state of Yukon geoscience. Over two days, participants reviewed the first plan, as well as work that was done since 1995, to produce a new set of priorities to guide Yukon geoscience into the next millenium. The first morning included introductory remarks and background information. On the afternoon of the first day, participants were divided into four groups to discuss: 1) 'Hard rock' bedrock mapping; 2) 'Soft rock' bedrock mapping; 3) Surficial mapping and placer research; and 4) Mineral deposit studies, geophysical surveys and geochemical surveys. Each group was asked to re-examine the needs and priorities outlined in the Marsh Lake Document in light of the progress made over the last four years and the changed environment for geoscience. The groups reassembled on the morning of the second day to report and discuss priorities. The meeting adjourned at noon with group leaders remaining to write their reports in the afternoon. This document summarizes the results of the workshop. It represents a consensus of 42 experts on Yukon geology and will be used in program planning to ensure that priorities are met and that maximum value is obtained from available funding.

Consensus was reached on several general issues:

- Delivery of geoscience is presently split among several agencies with complementary roles: the Geological Survey of Canada (GSC), Indian and Northern Affairs Canada (DIAND), Government of the Yukon (YTG), and various universities. Participants were enthused with the close collaboration and cooperation these agencies have demonstrated in the past and strongly encouraged them to continue. Presently the Yukon Geology Program furthers this purpose. It is jointly funded and administered by DIAND and YTG, includes one geologist seconded from the GSC, and funds university research.
- A competitive, comprehensive geoscience database not only promotes and supports mineral exploration but also economic development in general. It provides a sound, unbiased scientific basis for land management, including regulatory decisions and land withdrawals.
- More demands are being placed on limited resources. Yukon geological information is no longer needed only by the mining and exploration industry, but also by oil and gas interests, land managers, environmental regulators, tourists, educators, and the general public.
- Geological mapping is the cornerstone of geoscience; systematic programs of bedrock and surficial mapping at both regional, or framework (1:250 000) and detailed (1:50 000) scales are essential.
- Information must be made more accessible through innovative new digital products such as map compilations and databases, and new distribution mechanisms such as the Internet.
- Geoscience has become both complex and sophisticated. Increasingly, advances in understanding will be made through multidisciplinary projects such as the National Mapping Program (NATMAP).

Some specific recommendations (Table 2, summary) were:

1. Six 1:250 000 scale and fifty 1:50 000 scale map areas were given high priority for bedrock mapping. The Yukon-Tanana Terrane requires the most work because it underlies most of central Yukon, is one of the least understood parts of the Canadian Cordillera and has high potential for volcanogenic massive sulphide (VMS) deposits and granite hosted gold deposits. Other priorities were distributed throughout most other geological elements of the Yukon. However, the less complex geology of most sedimentary basins with hydrocarbon potential lend themselves to regional rather than detailed mapping.
2. Three 1:250 000 scale map areas were given high priority for surficial mapping. These would provide a framework for evaluating placer potential in the Dawson Range and complement bedrock mapping projects underway in south central Yukon.
3. Five priorities addressed placer specific studies:

   a) Continue water and mining technology research in support of the Yukon Placer Authorization Review in 2001.

   b) Increase liaison and contact with placer miners while undertaking deposit studies.

   c) Develop the Yukon Placer MINFILE database.

   d) Develop a unified approach to sampling, describing and mapping of placers and surficial deposits.

   e) Develop user-friendly, simplified products for use by schools, general public and miners.
4. The recommendation for mineral deposit studies concentrated on style, approach and focus, rather than prioritizing specific studies. A balanced approach was recommended in which short term needs to provide immediate support to industry would complement longer term studies and compilation projects in areas not necessarily of immediate interest. Recommendations included:

   a) A 'hot play' geologist would work to stimulate and support current exploration plays with short term projects while a 'key correlation' geologist would undertake longer term metallogenic studies.

b) Deposit specific studies are most appropriately undertaken as university thesis projects with industry involvement.

c) Update of the Yukon MINFILE is urgent.

d) Compilation Reports should be a long term goal.

e) There is a need to compile and archive data from defunct mining camps.

f) Compilations of regional metallogeny are needed.

g) The 'Map Place' in British Columbia is a model that should be considered for digital data distribution on the Internet.

h) Develop a set of 'mineral deposit models' for the Yukon, based on British Columbia models.

i) The mineral resource assessment process could be used to generate many of the compilations recommended above.

5. Standardization and compilation of existing regional stream sediment geochemistry data was highly recommended along with completion of Regional Geochemical Surveys (RGS) for the Yukon.
6. Till geochemical surveys in selected areas were recommended.
7. Regional aeromagnetic surveys should be completed by the GSC, with Nahanni map area being a priority.
8. Detailed multi parameter surveys were acknowledged as beneficial for geological mapping and mineral exploration in areas with poor outcrop, but their expense was considered a limiting factor for a small geological survey. Stewart River (115 N&O) is the preferred area for new multi parameter surveys.

# INTRODUCTION

Four years after the first Yukon Geoscience Planning Workshop (the Marsh Lake Workshop, Yukon Geoscience – A Blueprint for the Future, Yukon Geology Program, March, 1995), forty two representatives (Table 1) of industry, academia, and government met at the High Country Inn in Whitehorse to re-examine the state of Yukon geoscience. Over two days, with the expert facilitation of Steve Morison, Gartner Lee Ltd., the participants reviewed the first plan, the work that was done since 1995, and produced a new set of priorities to guide Yukon geoscience into the next millenium (Table 2). The 1999 Yukon Geoscience Planning Workshop had a format similar to the 1995 workshop and many of the original participants were able to attend. This continuity greatly added to the quality and credibility of the input. It is a tribute to the first plan that many of the original priorities remain the same in this document. Still, there are significant changes and the exercise has given reassurance that Yukon geoscience is on track.

The organization of this Workshop differed only slightly from the first. It began with introductory remarks from Mr. Maurice Albert, Deputy Minister of Economic Development, Government of the Yukon; Carl Schulze, President of the Yukon Chamber of Mines; and Mike McDougall, President of the Yukon Placer Miners Association. Background information included an overview of the Marsh Lake workshop and progress to date; an update of Yukon oil and gas by Dave Downing; and an overview of recent advances in Yukon geology by Steve Gordey, Lionel Jackson, and Craig Hart. On the afternoon of the first day participants were divided into four groups to discuss: 1) 'Hard rock' bedrock mapping; 2) 'Soft rock' bedrock mapping; 3) Surficial mapping and placer research; and 4) Mineral deposit studies, geophysical surveys and geochemical surveys. Each group was asked to re-examine the needs and priorities outlined in the Marsh Lake Document in light of the progress made over the last four years and the changed environment for geoscience. The groups reassembled on the morning of the second day to report and discuss priorities. The meeting adjourned at noon with group leaders remaining to write their reports in the afternoon.

A number of factors combined to set a somewhat different tone from the Marsh Lake meeting. The environment for government led geoscience has changed over the past four years. In 1995, Mineral Development Agreements were coming to an end. The Geological Survey of Canada along with most provincial geological surveys was in the midst of traumatic budget cuts, layoffs, and reorganizations. At the same time, the complementary roles of federal and provincial geological surveys were being clarified through negotiation of intergovernmental

***Table 1.*** *Delegate list.*

| | |
|---|---|
| Grant Abbott | Yukon Geology Program/ DIAND |
| Shirley Abercrombie | Yukon Geology Program/YTG |
| Lynn Anglin | Geological Survey of Canada, Ottawa |
| Ron Berdahl | Prospector |
| Tim Bird | Consultant |
| Jeff Bond | Yukon Geology Program/ DIAND |
| Michael Burke | Yukon Geology Program/ DIAND |
| Gerry Carlson | President, Copper Ridge Explorations |
| Rob Carne | Archer, Cathro and Associates (1981) Ltd. |
| Jim Christie | Gimlex Resources |
| Maurice Colpron | Yukon Geology Program/YTG |
| Sandy Colvine | Geological Survey of Canada, Pacific Region, Victoria |
| Rick Diment | Viceroy Resources |
| Dave Downing | Oil and Gas, Economic Development, YTG |
| Diane Emond | Yukon Geology Program/DIAND |
| Kenneth Galambos | Yukon Geology Program/YTG |
| Steve Gordey | Geological Survey of Canada, Vancouver |
| Craig Hart | Yukon Geology Program/YTG |
| Fran Hein | University of Calgary |
| Roger Hulstein | Kennecott Canada Inc. |
| Julie Hunt | Yukon Geology Program/ DIAND |
| Lionel Jackson | Geological Survey of Canada, Vancouver |
| Stephen Johnston | University of Victoria |
| Larry Lane | Geological Survey of Canada, Calgary |
| Bill LeBarge | Yukon Geology Program/ DIAND |
| Grant Lowey | Yukon Geology Program/YTG |
| Michael McDougall | President , Klondike Placer Miners Association |
| Steve Morison | Gartner Lee Ltd. |
| Jim Mortensen | Department of Earth and Ocean Sciences, University of British Columbia |
| Don Murphy | Yukon Geology Program/YTG |
| Dennis Ouellette | President, Yukon Prospectors Association |
| Suzanne Paradis | Geological Survey of Canada, Victoria |
| Jean Pautler | Teck Exploration |
| Lee Pigage | Yukon Geology Program/YTG |
| Paul Price | Canadian 88 Energy, Calgary |
| Derek Rhodes | Cominco Ltd., Vancouver |
| Charlie Roots | Geological Survey of Canada, Vancouver /Whitehorse |
| Stuart Schmidt | Placer Miner |
| Carl Schulze | President, Yukon Chamber of Mines |
| Robert Shives | Geological Survey of Canada, Ottawa |
| Moira Smith | Teck Exploration, Kamloops |
| Robert Stroshein | BYG Natural Resources |

***Table 2.*** *Summary of recommended work (incorporates new recommendations with those which remain unchanged from the 1995 Marsh Lake Document).*

| | HIGH PRIORITY | MEDIUM PRIORITY | LOW PRIORITY |
|---|---|---|---|
| **BEDROCK MAPPING 1:250 000 SCALE** | Watson Lake 105A; Laberge 105E; Frances Lake 105H; Nadaleen River 106C; Snag 115J&K; Eagle River 116L<br>**Mainly compilation:**<br>Whitehorse 105D; Glenlyon 105L/SW; McQuesten 115P/SW; Finlayson Lake 105G/NE; | Coal River 95D; Flat River 95E; Nash Creek 106C; Dezadeash 115A; Larsen Creek 116A; Ogilvie River 116F&G; Hart River 116H; Porcupine River 116J&K; Old Crow 116N&O; Bell River 116P | Aishihik Lake 115H; Carmacks 115I; Wind River 106E; Snake River 106F; Martin House 106K; Trail River 106L; Blow River 117A&B |
| **BEDROCK MAPPING 1:50 000 SCALE** | **Insular Belt**<br>Kluane Lake 115F/7,8,9,10,15,16; 115G/2,3,5,6,12<br>**Yukon-Tanana Terrane**<br>Parts of 105B; 105G; 105L; 115N/O; 115P in conjunction with 1:250 000 framework mapping<br>Snag 115J/11,12 (may be in Windy Mckinley terrane)<br>**Selwyn Basin**<br>Coal River 94D/3<br>Finlayson Lake 105G/9,16<br>Frances Lake 105H/4,5,12,13<br>Quiet Lake 105F/9,15,16<br>Finlayson Lake 105G/2,5<br>Glenlyon 105L/9,14,15,16<br>Nadaleen 106C/1,2,3,4<br>Larsen Creek 116A/3,4<br>Dawson 116B/1,4<br>**Windy McKinley terrane**<br>Kluane Lake 115F/16; 115G/11,12,13,14<br>Snag 115K/1<br>**Southeast Yukon**<br>La Biche 95C/5,11<br>**Intermontane Belt (Whitehorse Trough)**<br>Whitehorse 105D/7,10<br>Laberge 105E/1,5,6,7,10,12<br>Aishihik Lake 115H/8<br>*With geophysics*<br>Laberge 105E/13,14<br>Carmacks 115I/1,2,7,8,10,11,13<br>Glenlyon 105L/3,4<br>**North Yukon**<br>Ogilvie River 116F/1,8,9,10,15,16; 116G/4,5,12,13<br>Old Crow 116O/2,3,4,7,8; 116P/5,6,7,8,9,10,11,12 | **Insular Belt**<br>Dezadeash 115A/2,3,6,11,13<br>Mt. St. Elias 115B/16; 115C/5,6,11,12<br>**Yukon-Tanana Terrane**<br>Aishihik 115H/1<br>Snag 115J/8<br>**Ogilvie-Wernecke Mountains**<br>Nadaleen 106C/5,6,11,12<br>Wind River 106E/1,4<br>Snake River 106F/4<br>Larsen Creek 116A/9,12<br>Hart River 116H/1<br>**Selwyn Basin**<br>Nadaleen 106C/1,2,3,4<br>Nash Creek 106D/5,6<br>Larsen Creek 116A/5,6,7,8<br>**Intermontane Belt (Whitehorse Trough)**<br>Whitehorse 105D/1,8,9 | **Insular Belt**<br>**Ogilvie-Wernecke Mountains**<br>Nadaleen 106C/7,8,9,10,15,16<br>**Intermontane Belt (Whitehorse Trough)**<br>Whitehorse 105D/7,10 |

***Table 2.*** *Continued*

| | HIGH PRIORITY | MEDIUM PRIORITY | LOW PRIORITY |
|---|---|---|---|
| **SURFICIAL MAPPING 1:250 000 SCALE** | Watson Lake 105A; Wolf Lake 105B; Snag 115J/K | Whitehorse 105D; Laberge 105E; Dezadeash 115A | La Biche River 95C; Coal River 95D; Flat River 95E; Lansing 105N; Niddery Lake - 105O; Eagle River 116I; Trail River 106L; Martin House 106K |
| **PLACER RESEARCH General direction** | Water and mining technology<br>Industry liaison | Placer MINFILE database<br>User friendly placer products | Unified sampling scheme among all surficial reseachers |
| **MINERAL DEPOSIT STUDIES General Direction and Product Delivery** | 'Hot play' Geologist for short term needs<br>'Key Correlation' Geologist for longer term studies<br>Deposit specific studies through graduate theses with industry support | Update Yukon MINFILE<br>Deposit type Bulletins (bulletins on mineral districts)<br>Compile and synthesize data from dormant mines and camps; Theses | Website distribution<br>Develop Yukon Deposit models<br>Develop regional metallogenic maps and RGS compilations, as part of resource assessments. |
| **MINERAL DEPOSIT STUDIES (only high priorities modified from Marsh Lake Document)** | Granite related gold deposits<br>VMS deposits in Yukon-Tanana Terrane<br>Geologic Setting of Mineral Camps (i.e., Keno Hill) | Mesothermal shear zone hosted gold deposits<br>Wheaton River gold district<br>Mantos (e.g., Ketza Seagull type)<br>Industrial Minerals | Wernecke Breccias; Magmatic Cu/Ni/PGM; Tungsten skarns; Coal; Epithermal gold along Tintina Fault; Cu/Au skarns; Mississippi Valley- & Blende type Zn/Pb deposits; Sedex Ni; Dimension Stone; Jade; Asbestos; Tin; Sedimentary iron formation; Uranium; Rare Earths; Porphyry Cu/Au systems in Dawson Range |
| **REGIONAL GEOCHEMICAL SURVEYS 1:250 000 SCALE** | Equalization of RGS data across Yukon, in conjunction with regional geochemical atlases. Focused till geochemical surveys in the Finlayson Lake area and possibly the Keno Hill Area. Complete NGR coverage in southeast Yukon: parts of La Biche River 95C and Flat River 95E | Complete RGS surveys for northern Yukon: Porcupine River 116J/K; Old Crow 116O/N; Bell River 116P; and parts of Bonnet Plume 106B; Nadaleen River 106C; Wind River 106E; Snake River 106F; Trail River 106L; Martin House 106K; Ogilvie River 116F/G; Hart River 116H; and Eagle River 116I<br>Reanalysis of NGR samples for additional elements. | Orientation Case studies<br>• Soil geochemical sampling with mapping<br>• Fine fraction sampling and gold/ platinum analyses<br>• Lithogeochemistry<br>• Fine fraction sampling and gold analysis<br>• Heavy mineral concentrate studies<br>• Placer lode source studies<br>• Enzyme leach/MMI<br>• Water surveys<br>• Biogeochemistry |
| **REGIONAL GEOPHYSICAL SURVEYS** | Purchase and compilation of existing private sector geophysical data.<br>Provide access to remote sensing tools | Airborne gamma ray-mag VLF surveys; Stewart River 115N/O | Complete regional aeromagnetic coverage of Yukon: parts of Bonnet Plume Lake 106B; Nadaleen River 106C; Nash Creek 106D; Wind River 106E; Snake River 106F; Martin House 106K; and Trail River 106L<br>Possibly infill survey in Mayo - 105M |

RGS: Regional Geochemical Survey
NGR: National Geochemical Reconnaissance Program
VMS: volcanogenic massive sulphide
MMI: Mobile Metal Ion

geoscience accords. In contrast, since 1995, federal and territorial support for Yukon Geoscience has remained stable and actually saw a small increase from the territorial government this year. Federal geoscience funding has stabilized and is seeing small increases in selected areas such as development and distribution of digital information. In the Yukon, after the end of Mineral Development Agreements in the spring of 1996, the Department of Indian Affairs and Northern Development, the Government of the Yukon, and Geological Survey of Canada entered into a loose collegiate arrangement. This placed all government led geoscience programs based in Whitehorse under one umbrella called the Yukon Geology Program. The Yukon Geology Program is now looked on across Canada as a model for intergovernmental cooperation, but it is a temporary arrangement. Devolution of the Northern Affairs Program to the Government of the Yukon is tentatively scheduled for the year 2000, and a true Yukon Geological Survey may soon become a reality. In 1998, responsibility for oil and gas resources was transferred to YTG from the federal government, and the Territory entered into a transitional period with respect to involvement in oil and gas geology activities. Because the dominant clients are based in Calgary, responsibility for geology mapping in prospective sedimentary basins has, in the past, resided with GSC Calgary. Devolution has resulted in an increasing interest to be involved in 'soft rock' geology activities by the Government of the Yukon.

Participants were well aware that the viability of mining and mineral exploration in Canada continues to be threatened by three factors: 1) the steady decline in commodity prices, most of which are now at 20 year lows; 2) increased complexity of the regulatory process, and in the Yukon, regulatory uncertainty; and 3) loss of access to large tracts of prospective land by creation of parks and protected areas through the land claims process and through processes such as the Yukon Protected Areas Strategy. Many developing countries are accelerating geological mapping and other activities to promote mineral exploration and development, and some are nearing the quality of Canadian databases. There was consensus that a competitive geoscience database not only promotes and supports mineral exploration, but also economic development in general, and provides a sound, unbiased scientific basis for land management, which includes regulation and land withdrawal.

There was general consensus on recent trends in geological research. Geological maps, both bedrock and surficial, continue to form the fundamental framework upon which other geological studies are based. As stated in the Marsh Lake Document, not only are most Yukon geological maps not at an adequate level of detail, advances in scientific theories and knowledge periodically require varying degrees of reinterpretation and collection of new data to maintain relevance. Geological mapping in particular and geological studies in general are becoming more sophisticated and multidisciplinary with essential contributions coming from such diverse disciplines as structural geology, paleontology, sedimentology, lithogeochemistry, and geophysics. Partnerships such as NATMAP (National Mapping Program) between government organizations and universities are becoming essential for significant scientific advances. The coming of age of information technology and the Internet has revolutionized the dissemination of information. Geological Surveys now produce fully digital information, but are still coming to grips with various ways to increase productivity, take full advantage of the Internet, and to find new, more creative and useful formats in which to integrate and disseminate information. The most notable success in the Yukon has been the Digital Geology of the Yukon, compiled by S. Gordey of the Geological Survey of Canada.

Many of the priorities for mapping and for other studies set out in the Marsh Lake Document were reaffirmed during the second workshop. Rather than re establish all of the priorities, the groups tended to put more emphasis on high priority areas, and less on the review of medium and low priority areas. For mineral deposit studies and placer research, the emphasis was on approaches to research rather than on specific areas or deposit types on which to work. Some of the changes in mineral deposit priorities corresponded to changes in exploration interest. Some revisions to high priority map areas did not reflect changes in geological understanding since Marsh Lake, and probably reflected the different makeup and experience of the groups. Priority areas are therefore not cast in stone. One of the reasons why priorities remained similar to those set at Marsh Lake was the small dent made in the list set out four years ago. For instance, of the six high priority 1:250 000 scale maps identified at Marsh Lake, half of one was completed; of the approximately thirty five high priority 1:50 000 scale maps identified, two and a half were completed; and one mineral deposit study was completed. This discrepancy, for the most part, merely reflects the available level of resources.

The exercise had several limitations. As at Marsh Lake, it identified high priority needs that, given present resources, are far beyond the capability of the Yukon Geology Program and the Geological Survey of Canada to undertake in a three- to five year time frame. In the spirit of cooperation, no effort was given to identifying which organization should undertake which work. Different types of studies and research were not ranked against one another. Participants largely represented the interests of the mining and exploration industry, and other needs such as derivative products (i.e., for public information, tourism, education, groundwater, terrane hazards, and environmental geology) were not addressed. Time constraints prevented a thorough discussion of information technology and the Internet. Thus this document is not a work plan; it merely sets out a broad framework of geoscience needs and priorities from which a work plan can be constructed by taking into account the constraints of budgets, available personnel, and other factors.

# COMMENTS BY SPONSORING ORGANIZATIONS

## MAURICE ALBERT

**Deputy Minister, Department of Economic Development, Government of the Yukon**

Mr. Albert welcomed the delegates and agreed to help develop and implement a five year plan for the Yukon Geology Program. The plan developed from the workshop will impact funding. Changes are taking place in the way resources are being administered in the Yukon. As of November 1998, the Government of the Yukon (YTG) has taken responsibility for administration of oil and gas, and will soon have regulatory responsibility for mineral resources. The Development Assessment Process is imminent. It will create a 'one window' approach to environmental regulation, although issues on how it will be implemented remain to be resolved. YTG is committed to an effective, efficient regime and is looking to hear advice from industry on what changes are necessary. YTG intends to be responsive to industry and is relying on input from the workshop to set priorities and point the Yukon Geology Program in the right direction.

## CARL SCHULZE

**President, Yukon Chamber of Mines**

"The Yukon Chamber of Mines is a strong supporter of the Yukon Geology Program. The Chamber is an independent, non-governmental organization representing all facets of the mining industry, including major, mid tier, and junior mining companies, prospectors, individual land holders, and applicable service and support industries. Our mandate is to improve the climate for mining and exploration investment in the Yukon to the greatest extent possible. We function primarily as a lobby group attempting to reduce or curtail unnecessarily convoluted or restrictive assessment and regulatory regimes, to improve political awareness of the importance of mining, and to protect the rights to security of tenure inherent in the Quartz Mining Act. Although the placer mining industry and Yukon prospectors have their own representative organizations, they are allied with us towards essentially the same goals.

"The Chamber supports establishment of data that will facilitate economic development across the Yukon. We are in support of a regional geoscience database at 1:250 000 scale, consisting primarily of geological data, with a common legend, remote sensing data, stream sediment geochemical data with multi-element analysis, and compilation of regional aeromagnetic data. The object of these comparatively inexpensive surveys is to improve knowledge of tectonic processes across the Yukon, and to produce a database to facilitate grass roots exploration useable by all factions of the exploration industry from major companies to individual prospectors. Such information should be accessible to all interested parties, available in both hard copy and digital form, through as many outlets as possible. This database will provide a basis for exploration companies to enter a region and make discoveries. More detailed surveys (i.e., at 1:50 000 scale) may result in conflict of interest if specific companies benefit directly from a particular program. Some conflict may be unavoidable if detailed surveys of highly prospective terrane largely benefiting the industry are undertaken.

"The Chamber also supports detailed study of geological features influencing emplacement of mineral deposits, for example, the Tombstone Tungsten Plutonic Suite. Analysis of such suites will yield valuable information on factors controlling significant mineralization. We also support detailed study of favourable terranes such as the Selwyn Basin and Yukon-Tanana Terranes, among others, to improve understanding of structural and stratigraphic characteristics influencing mineralogical setting. Results of these studies in certain areas can be extrapolated to cover entire terranes or suites. We also support spending on placer and surficial geology studies, as knowledge gained from these surveys will benefit both the placer and hard rock mining industries.

"The Chamber does not support funding to the Geoscience Program to be spent on mineral resource assessment in conjunction with the Protected Areas Strategy. These assessments may be necessary to ensure parks will not be created across areas of high potential; however, these costs should be borne by the proponent agency of such parks, and the results of such studies should be objective. If such work is borne by the Geoscience Office, it will detract from funding and efforts to improve the regional database which are directed towards stimulating the mining and exploration industry. We do not support detailed expensive surveying of local areas, unless these will significantly improve knowledge of a particular suite or terrane.

"We feel that the Geoscience Department is on the right track towards completion of a Yukon wide database, with economic interests in mind, and will support continued funding of the office. Hopefully this workshop will be effective in steering the Geoscience exploration programs towards this end, and this will continue following devolution."

## MIKE MCDOUGALL

**President, Klondike Placer Miners Association**

"There are 3 main issues confronting our industry today:

- regulatory changes
- environmental assessment changes
- declining placer reserves

"I believe that the Yukon Geology Program has a responsibility to assist the placer mining industry with all of these.

"**Regulatory changes**: The Yukon Placer Authorization (YPA) will have a major review in 2001. The YPA assures the placer mining industry of a clear set of rules which we can deal with. The effluent standards and the stream restoration requirements protect the aquatic environment, provide for optimal conditions upon closure of a mine for reclamation and allow the placer miner to extract gold in a relatively cost effective manner.

"Mining land use regulations will come into force during the 2000 field season. In the meantime, we are required to live within the operating conditions set out in the regulations for exploration programs. We have been hoping that the one window approach would be maintained through the Water Board. This is in doubt.

"Mine site production regulations are currently being drafted. It is unclear what effect these will have on our industry.

"**Environmental assessment changes**: As you all know, the Development Assessment Process or DAP will profoundly change how environmental assessment (EA) is conducted in the Yukon Territory. We are hopeful that the vast majority of the EA approvals will be made at the designated office level in the communities for placer mining and exploration projects. This new federal legislation adds to the overall uncertainty in the Yukon today.

"**Declining reserves**: The placer mining industry in the Yukon is gradually depleting the reserves in the traditional areas to the point that they are no longer viable. There is very little systematic placer exploration in the territory and the KPMA is quite concerned that our industry will continue to shrink. We need a large exciting discovery to spur development and attract investment.

"All of the above challenges can be met with a clear vision of our collective future, that is, mining is crucial to the short term and long term development of the Yukon Territory. Knowledge can provide us with the tools to assist in realizing this vision.

"The Yukon Geology Program has initiated several programs, which we support. However, we feel there is more that can be done to support the placer mining industry. Examples include:

1. Water sampling program to assess the downstream impact from placer mining. I understand this was initiated last summer and a plan is being developed for the 1999 field season.
2. Development of grain size database. We haven't seen the results of this work.
3. Property scale mapping program for database development and to ensure that there is a clear picture of the placer industry each season. This is important to assist with the discussions at the Yukon Placer Committee. Every placer mine should be visited each summer by a government geologist to document the industry.
4. New geoscience inventories. For example, heavy mineral sampling and analysis of prospective creeks. We are concerned that the placer geoscience program might be on the academic side.
5. Placer Deposit MINFILE."

# 'HARD-ROCK' BEDROCK MAPPING

The group consisted of co facilitators Steve Johnston (University of Victoria) and Don Murphy (YGP), along with participants Ron Berdahl (Liberty Minerals), Mike Burke (YGP), Maurice Colpron (YGP), Sandy Colvine (GSC), Al Doherty (Aurum Geological Consultants), Ken Galambos (YGP), Steve Gordey (GSC), Jean Pautler (Teck Exploration), Charlie Roots (GSC), and Robert Stroshein (BYG).

This group was charged with the responsibility of establishing the priority areas for new 'hard rock' geological mapping and compilation at 1:250 000 scale (framework mapping or compilation) and new 1:50 000 scale geological mapping, in those areas where the main focus is mineral exploration. Initially, the group's mandate overlapped with the 'soft rock' geological mapping group with respect to Selwyn Basin.

However, neither group was able to address Selwyn Basin adequately on Monday, and a separate review of this important region was held on Tuesday morning.

Several factors were considered in establishing priorities, including scientific merit, mineral potential, vintage of previous work (Figures 1, 2, and 3), necessary resources, possibilities for 'leveraged' cooperative programs such as NATMAP or SNORCLE (Slave Northern Cordillera Lithospheric Evolution), and in the case of 1:50 000 scale mapping, development or maintenance of local expertise. Framework mapping priorities were established using a combination of these factors; scientific merit and mineral potential were the main criteria for establishing priority areas at 1:50 000 scale. Another consideration for framework mapping was ease of completion through compilation of existing work plus some limited new work. However, the consensus view was that although there are a few areas (see below) that could fairly easily be brought up to a modern standard by compilation and limited new mapping, this type of work had a lower priority than projects comprising mainly new mapping.

The Marsh Lake Document was used extensively in the process of establishing priority areas. In particular, in the case of framework mapping we started with the question: "Are the priorities for framework mapping identified in the Marsh Lake Document still current, in light of current scientific/economic trends and in light of what is either in progress or planned since Marsh Lake?"

Table 3 and 4 show a summary of recommendations from the workshop. Overall, areas underlain by Yukon Tanana Terrane were accorded the highest priority for mapping at both scales. Yukon-Tanana Terrane is still considered to be the least understood, least studied and most prospective geological element in the territory.

## 'FRAMEWORK' MAPPING (1:250 000 SCALE)

Since the Marsh Lake meeting, some areas that were considered to be high priority have been advanced to the 'in progress' or 'planned' stages (Figure 4). These include Lansing (105N), which is currently in the write-up stage, and Stewart River (115N,O) and Wolf Lake (105B/SW), which have been enveloped in the Ancient Pacific Margin NATMAP and will be started the 1999 field season. The remaining high priority areas are McQuesten (115P/SW), Nadaleen River (106B), and Frances Lake (105H). La Biche (95C), which was considered to be medium priority at Marsh Lake, is currently being re mapped as part of the Central Forelands NATMAP project.

After reevaluating the Marsh Lake priorities in the light of new factors such as the greater importance now given to Yukon Tanana Terrane, the following conclusions were drawn (Table 3):

- McQuesten SW (115P/SW), Nadaleen River (106C) and Frances Lake (105H) are all still considered to be high priority. Being underlain by Yukon Tanana Terrane and intrusive rocks, McQuesten SW has high potential for VMS deposits and intrusion related deposits. It has received no modern mapping and is poorly understood. It is adjacent to Stewart River (115N east ½ & O) where new work will be done under the Ancient Pacific Margin NATMAP project. Mapping in McQuesten SW could also include a transect of the Tintina Fault as one of the few cross trench exposures occurs in Crooked Creek in this area. Frances Lake is underlain by Yukon Tanana Terrane, Selwyn Basin, and Cretaceous intrusions, is considered to have high mineral potential and is considered to be fairly attractive for exploration given the relatively good road infrastructure. Mapping in Frances Lake could also include a transect of the Tintina Fault as bedrock exposure comes close to the fault on both sides in adjacent Watson Lake (105A). No modern mapping at any scale is currently publicly available. New mapping in Frances Lake would be useful in interpreting the SNORCLE seismic transect. Nadaleen River presents the opportunity to address some of the most significant unresolved stratigraphic and structural problems in the Cordilleran miogeocline. It is underlain primarily by poorly understood early to late Proterozoic strata, Lower Paleozoic shelf and basinal sequences, and straddles the Richardson Fault Array, a poorly understood feature with a complex history that began in the Proterozoic. The Mesozoic structure and history is also complex and poorly understood. No modern mapping other than two 1:50 000 scale map sheets exists for this area.

*Table 3. Summary, framework (1:250 000 scale) bedrock mapping (update of Marsh Lake data by both 'Hard rock' and 'Soft rock' groups).*

| PRIORITY | NTS | NAME | RATIONALE/PROBLEMS |
|---|---|---|---|
| **'Soft-rock' Group** | | | |
| **HIGH** | 95C | La Biche River | Fieldwork committed to begin in 2000; oil and gas interest; MVT potential; Beaver River fault with associated Paleozoic shelf to basin boundary; originally compiled from oil industry data; poor correlation between surface and subsurface; no available report. |
| | 116I | Eagle River | Difficulty with correlation of existing surface data to subsurface seismic; revisions necessary to Paleozoic, Mesozoic and Tertiary stratigraphy and structure; oil and gas potential; mineral potential; land use planning; park boundary and First Nation issues. |
| | 105D,E | Whitehorse, Laberge | Uncertain hydrocarbon potential; need revised Mesozoic stratigraphy, thermal maturation, palynology, micropaleontology and organic chemistry; compilation possible for much of Whitehorse. |
| **MEDIUM** | 95D,E | Coal R., Flat R. | Oil and gas interest; SEDEX potential; Regional stratigraphy; Paleozoic facies changes; Mesozoic structural interpretation. |
| | 116F/G, H,J/K, N/O,P | Ogilvie R., Hart R., Porcupine R., Old Crow, Bell R. | Issues similar to Eagle River; Proterozoic inliers are widespread but virtually unknown; lower priority due to less oil and gas potential and greater amount of work required to upgrade. |
| **LOW** | 117B,C | Blow River/ Davidson Mtns. | Issues similar to Eagle River; lower priority due to land withdrawals from future development. |
| | 106E,F,K,L | Wind River, Snake River, Martin House, Trail River | Geology is less complex than other parts of Northern Yukon and areas are more remote from existing transportation infrastructure. |
| **'Hard-rock' Group** | | | |
| **HIGH** | 105A | Watson Lake | Poorly understood Paleozoic stratigraphy; regional correlation along northern Cassiar platform; includes elements of Yukon-Tanana/Slide Mountain terranes in uncertain relationship to North America; VMS, SEDEX and granite related mineral potential; Tertiary evolution of 'Liard River basin' could be addressed through geophysics; no report. |
| | 105B | Wolf Lake | Fieldwork begun in 1999. Relationship of Dorsey, Yukon-Tanana, Slide Mountain terranes to North America; part new field work, part compilation of pre-existing detailed coverage; critical to Lithoprobe SNORCLE seismic data interpretation. |
| | 106C | Nadaleen River | Poorly understood Proterozoic/Paleozoic stratigraphy; Proterozoic, Paleozoic, and Mesozoic structure; no available reports. |
| | 105G | Finlayson Lake | Compilation of northeast half possible with some fieldwork and recent and ongoing detailed mapping of parts of Yukon-Tanana Terrane; VMS, SEDEX and granite-related mineral potential. |
| | 105H | Frances Lake | Late Proterozoic/Paleozoic stratigraphy, Mesozoic structure; relations with Yukon-Tanana and Slide Mountain terranes; well-exposed; unclear relations of Mt. Billings Batholith as possible core complex; SEDEX and granite-related mineral potential; link to Lithoprobe SNORCLE transect. |
| | 115N/0 | Stewart River | Mapping begun in 1999. Variably sheared metamorphic rocks of poorly constrained age; poorly known distribution of rock units; modern synthesis lacking as area last examined by packhorse in mid-1930's; no report for most of area; high priority if done in conjunction with surficial geology studies and geophysics. |
| | 115P | McQuesten SW | Southwest of Tintina Fault; variably sheared metamorphic rocks of poorly constrained age; poorly known distribution of rock units; modern synthesis lacking; VMS and intrusion-related mineral potential. |
| | 115L | Glenlyon SW Compilation | Variably sheared metamorphic rocks of poorly constrained age; significant VMS potential; largely compilation after completion of 1:50 000 scale mapping of selected areas. |
| | 115J/K | Snag | Variably sheared metamorphic rocks of poorly constrained age; distribution of rock units moderately well known, but re-evaluation of structural interpretation and more geochronology required. |

***Table 3.*** *continued*

| PRIORITY | NTS | NAME | RATIONALE/PROBLEMS |
|---|---|---|---|
| **MEDIUM** | 106D | Nash Creek | Poorly understood Proterozoic/Paleozoic stratigraphy and Mesozoic structure; includes Ogilvie Platform and Selwyn Basin; available report and interpretations outdated. |
| | 116A | Larsen Creek | Poorly understood Proterozoic/Paleozoic stratigraphy and Mesozoic structure; includes Ogilvie Platform and Selwyn Basin; available report and interpretations outdated. |
| | 115A | Dezadeash | Northeast part; metamorphic rocks of poorly constrained age; inadequate existing bedrock information dates to mid-1940s. |
| **LOW** | 115H | Aishihik | Variably sheared metamorphic rocks of poorly constrained age; distribution of rock units moderately well known; same as Snag area, but information base in better shape because of recent detailed work, so rated as lower priority. |
| | 115I/NE | Carmacks | Compilation possible in light of recent detailed mapping; includes Yukon-Tanana Terrane and Whitehorse Trough; potential for variety of intrusion-related mineralization, but exposure poor. |
| | 105E | Laberge | Least known of areas underlying Stikine Terrane; requires stratigraphic re-investigation with strong paleontological and sedimentological control; includes parts of Yukon Tanana and enigmatic units of Slide mountain, Cache Creek? and/or Quesnel terrane affinities. |
| | 105D | Whitehorse | Primarily a compilation project; about half of area already mapped at detailed scale; mainly Stikine Terrane; some Yukon-Tanana Terrane; potential for variety of intrusion-related deposits. |

***Table 4.*** *Summary, detailed (1:50 000 scale) bedrock mapping (update of Marsh Lake data by both 'Hard rock' and 'Soft rock' groups).*

| PRIORITY | NTS | RATIONALE/PROBLEMS |
|---|---|---|
| **'Soft-rock' Group** | | |
| **North Yukon** | | |
| **HIGH** | 116F/1,8,9,16; 116G/4,5,12,13; 116O/2,3,4,7,8; 116P/5,6,7,8,9,10,11,12 | Structural complexity related to Middle Devonian and Tertiary orogenesis.<br><br>Mineral potential including porphyries associated with Devonian intrusion, phosphate iron formation and coal. National Park and land use issues. |
| **Southeast Yukon** | | |
| **HIGH** | 95D/5,11 | Commited as part of Central Forelands NATMAP. Scheduled to commence in 2000. |
| **Whitehorse Trough** | | |
| **HIGH** | 105D7,10; 105E/5,6,12,13; 105L/4; 115H/8; 115I/1 | Hydrocarbon potential paramount (including coal). Need for revised Jurassic Cretaceous stratigraphic framework and thermal maturation, palynology, micro paleontology, and organic geochemistry studies. |
| **'Hard-rock' Group** | | |
| **Insular Belt** | | |
| **MEDIUM** | Parts of 115A/2,3,6, 11,13; 115B/16 | Land use issues paramount. High potential for placer and lode gold occurrences. Contiguous with existing MDA mapping project. VMS copper deposits. Scenic values with high tourism potential. Buffer zone between Kluane Park and highway. Possibilities for enhancing tourism with interpretive studies, both outside and inside the Park (Dezadeash Group mainly). |
| **HIGH** | 115F/7,8,9,10,15,16; 115G/2,3 – Between Kluane Park and Alaska Highway only | Land use issues paramount. High potential for magmatic copper nickel deposits, copper-gold skarn, copper in mafic lavas. Scenic values with high tourism potential. Buffer zone between Kluane Park and Alaska Highway. Possibilities for enhancing tourism with interpretive studies. |
| **HIGH** | 115G/5,6,12 | These sheets comprise the area around the Wellgreen copper nickel PGE deposit. Detailed mapping was completed by DIAND, but never published. The maps should be located and published. High potential for magmatic copper nickel deposits, and scenic values with high tourism potential. Buffer zone between Kluane Park and Alaska Highway. Possibilities for enhancing tourism with interpretive studies. |
| **Intermontane Belt (Whitehorse Trough)** | | |
| **LOW** | 105D/7,10 | Well exposed area which includes City of Whitehorse and Whitehorse Copper Belt. Land use issues paramount. Contiguous with recent detailed mapping. These areas are from the Marsh Lake Document. Not discussed in 1999. |
| **MEDIUM** | 105D/8,9 | Contiguous with existing detailed mapping. High potential for mesothermal shear zone-hosted gold deposits, and contains several known occurrences. These areas are from the Marsh Lake Document. Not discussed in 1999. |
| **MEDIUM** | 105D/1 | Well exposed area with potential for mesothermal shear zone-hosted gold deposits. |
| **HIGH** | 105E/1,7,10,14 | Poorly exposed volcanic rocks of the Semenof Hill Block are not understood and may have high potential for VMS deposits. Potential for copper gold porphyry deposits in Jurassic alkalic intrusions in 105E/1. |
| **HIGH** with airborne geophysics | 105E/13,14; 105L/3,4; 115I/1,2,7,10,11 | Poorly exposed area with high mineral potential. Includes Minto and Williams Creek copper deposits and Tantalus Butte coal deposit. Crosses the poorly understood boundary between Stikine and Nisling terrane. These areas are from the Marsh Lake Document. Not discussed in 1999. |
| **HIGH** with airborne geophysics | 115I/8,10,13 | Critical, but poorly exposed area crossing the Teslin Fault. |
| **HIGH** | 105E/5; 115H/8 | Contains the Division Mountain coal deposit, and crosses the poorly understood boundary between Stikine and Nisling terrane. |

*Table 4. continued*

| PRIORITY | NTS | RATIONALE/PROBLEMS |
|---|---|---|
| **Yukon-Tanana Terrane** | | |
| **HIGH** | Parts of 105B; 105G; 105L; 115N/O; 115/P | Given the poorly understood nature of the Yukon-Tanana Terrane, the better-exposed parts of all of these map sheets merit detailed mapping, in conjunction with 1:250 000 scale framework mapping. VMS and granite-related precious metal potential. |
| **HIGH** | 115J/11,12 | Western extension of Dawson Range Mineral Belt. High potential in light of recent Pogo gold discovery. Not discussed in text. |
| **MEDIUM** | 115H/1 | Crosses the poorly understood boundary between Stikinia and Nisling terrane. Will provide critical information that will allow correlation between the two areas. |
| **MEDIUM** | 115J/8 | Contains relatively well exposed volcanic sequence related to nearby porphyry copper-gold systems, including the Casino deposit. |
| **Windy-McKinley Terrane** | | |
| **HIGH** | Parts of 115F/16; 115G/11,12,13; 115K/1 | Poorly exposed area underlain by Windy McKinley terrane, the least understood area in Yukon. Potential for VMS deposits. The level of exposure is too poor to allow for a typical 1:50 000 scale project. A more wide-ranging thematic study is envisaged. |
| **Selwyn Basin** | | |
| **HIGH** | 106C/1,2,3,4 | Possible to document the transition from platform to basin along the northern margin of Selwyn Basin. High concentration of base and precious metal occurrences. From Marsh Lake Document, not discussed in 1999. |
| **HIGH** | 116A/3,4; 116B/1,4 | Recent work along the northern margin of Selwyn Basin has identified large areas underlain by previously unrecognized strata, which are favourable hosts for SEDEX zinc-lead deposits, and complex stratigraphy and structure. Multispectral geophysical surveys recently flown over these areas give them high priority. |
| **HIGH** | 105F/9,15,16; 105G/2,5 | The structure and stratigraphy of the St. Cyr Assemblage along the inner margin of Cassiar Platform and its precise relationship to the Platform proper are poorly understood. Several SEDEX zinc-lead occurrences are known along the belt. |
| **HIGH** | 105L/9,14,15,16 | Northwestward extension of Anvil District stratigraphy. Mapping out of date; high SEDEX and granite-related gold and base metal potential. |
| **HIGH** | 105G/9,16; 105H/12,13 | Possibility of better understanding of the relationship between Selwyn Basin and the Yukon–Tanana Terrane. High SEDEX, VMS, and gold potential. |
| **HIGH** | 95D/3 | SEDEX potential associated with NE striking platform to basin transition. |
| **MEDIUM** | 106C/1,2,3,4 | Stratigraphy, structure and mineral potential of Proterozoic and Paleozoic strata along the northern margin of Selwyn Basin. SEDEX and gold-silver potential. |
| **MEDIUM** | 106D/5,6; 116A/5,6,7,8,12 | Recent work along the northern margin of Selwyn Basin has identified large areas underlain by previously unrecognized strata, which are favourable hosts for SEDEX zinc-lead deposits, and complex stratigraphy and structure. Absence of geophysical surveys gives medium priority rather than high for adjacent similar terrane rated high. |
| **Wernecke-Ogilvie Mountains** | | |
| **MEDIUM** | 106C/5,6,11,12; Parts of 106E/1,4; 106F/4; 116H/1 | Stratigraphy, structure and mineral potential of Proterozoic inliers to Ogilvie Platform. Most significant Wernecke Breccia occurrences in 106E/1 and 106F/4. Also SEDEX, 'Blende type' zinc, lead, and MVT potential. |
| **MEDIUM** | 106D/5,6; 116A/9,12 | Stratigraphy, structure and mineral potential of Proterozoic inliers to MacKenzie Platform. Setting of Hart River VMS deposit and Blende-type zinc-lead deposits may be elucidated. |
| **LOW** | 106C/7,8,9,10,15,16 | Stratigraphy and structure of Proterozoic and Paleozoic strata along the Snake River fault. High concentration of MVT and silver-rich zinc-lead occurrences. |

- Snag (115J/K) and Watson Lake (105A/NE), which were both considered as medium priority at Marsh Lake, have been elevated to high priority status. Snag is underlain primarily by Yukon-Tanana Terrane and is of interest for all the same reasons as Stewart River and McQuesten SW. In addition, Snag hosts the Windy-McKinley terrane about which little is known. Indeed, we currently don't know enough about this terrane to say that it is different from Yukon-Tanana Terrane; we currently don't know enough to assess its mineral potential. Watson Lake NE is considered to be a high priority for the same reasons as Frances Lake.

Of the areas now considered to be high priority, McQuesten SW is considered to have the highest priority.

- Coal River (95D), which was considered to be of low priority at Marsh Lake, has been elevated to medium priority in recognition of the possibility of obtaining a greater understanding of regional stratigraphic trends, in particular,

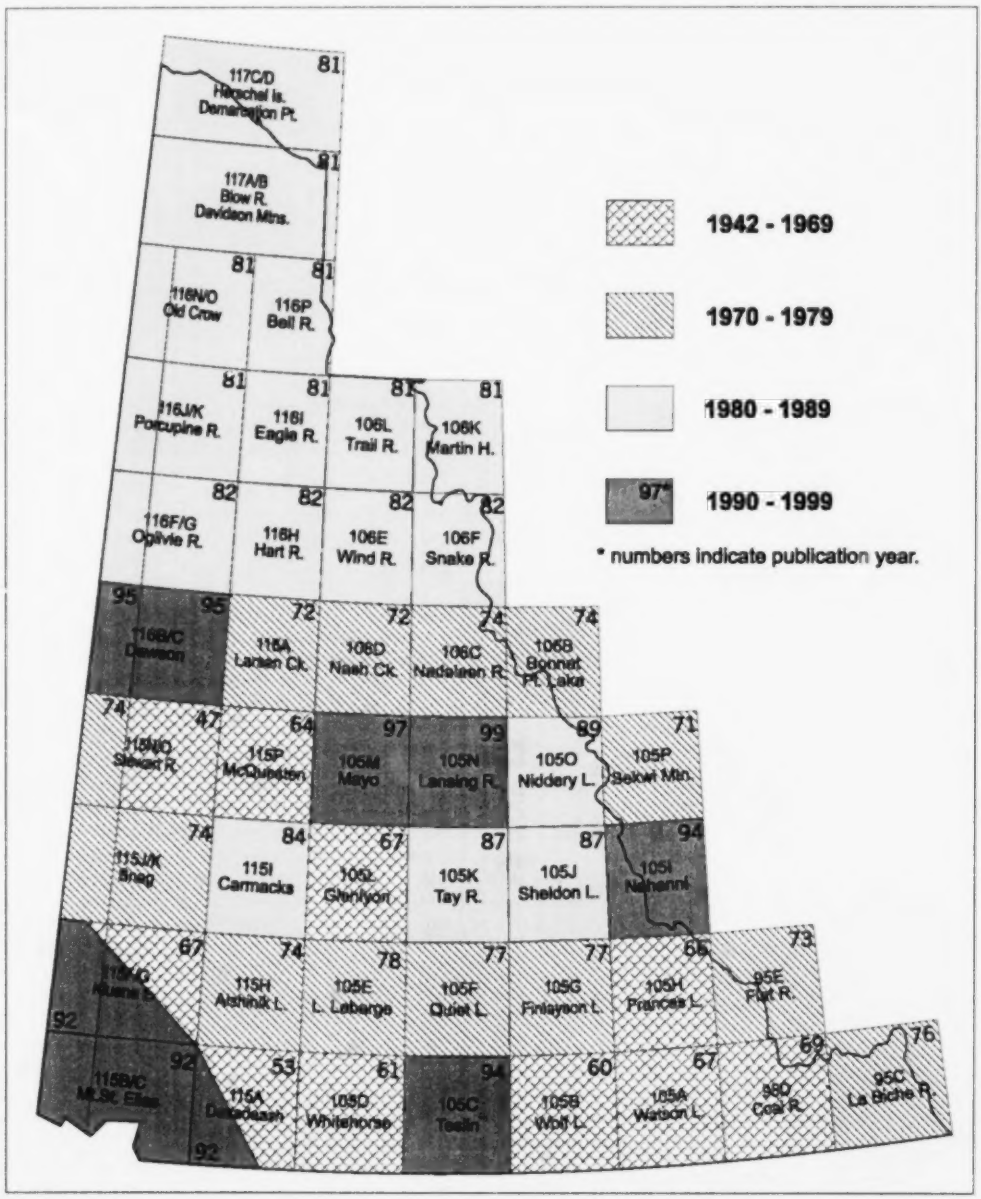
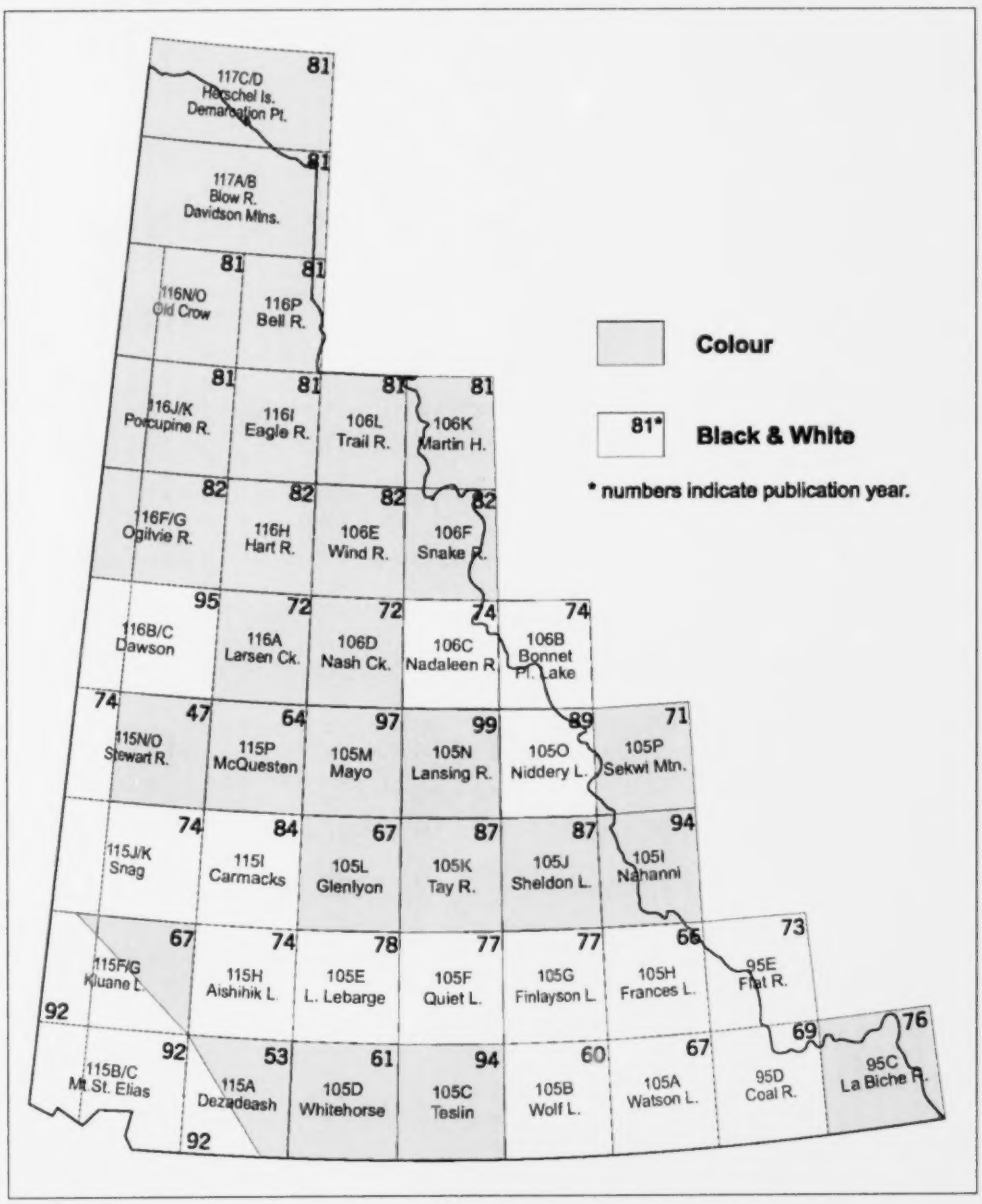



***Figure 1.***
*Most recent map, 1:250 000 scale.*

the east northeast trending Lower Paleozoic platform-to-basin facies transition, and associated potential for zinc mineralization. In addition, the most recent map was released in 1969. The framework geology of this area is thought to be reasonably well understood so it is not deemed a high priority area for framework mapping; however, parts of the area merit high priority for 1:50 000 scale mapping, mainly to investigate the potential for SEDEX zinc lead silver deposits.

With the exception of the above, the assignment of priorities in the Marsh Lake Document is unchanged. Larsen Creek (116A), Nash Creek (106D) and Dezadeash (115A/NE) are still considered to be medium priority.

Owing to a significant amount of relatively recent or planned 1:50 000 scale work, several areas stand out as being ready for release as compilations, with minimal additional field work, as follows:

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*Most recent 1:250 000 scale map.*

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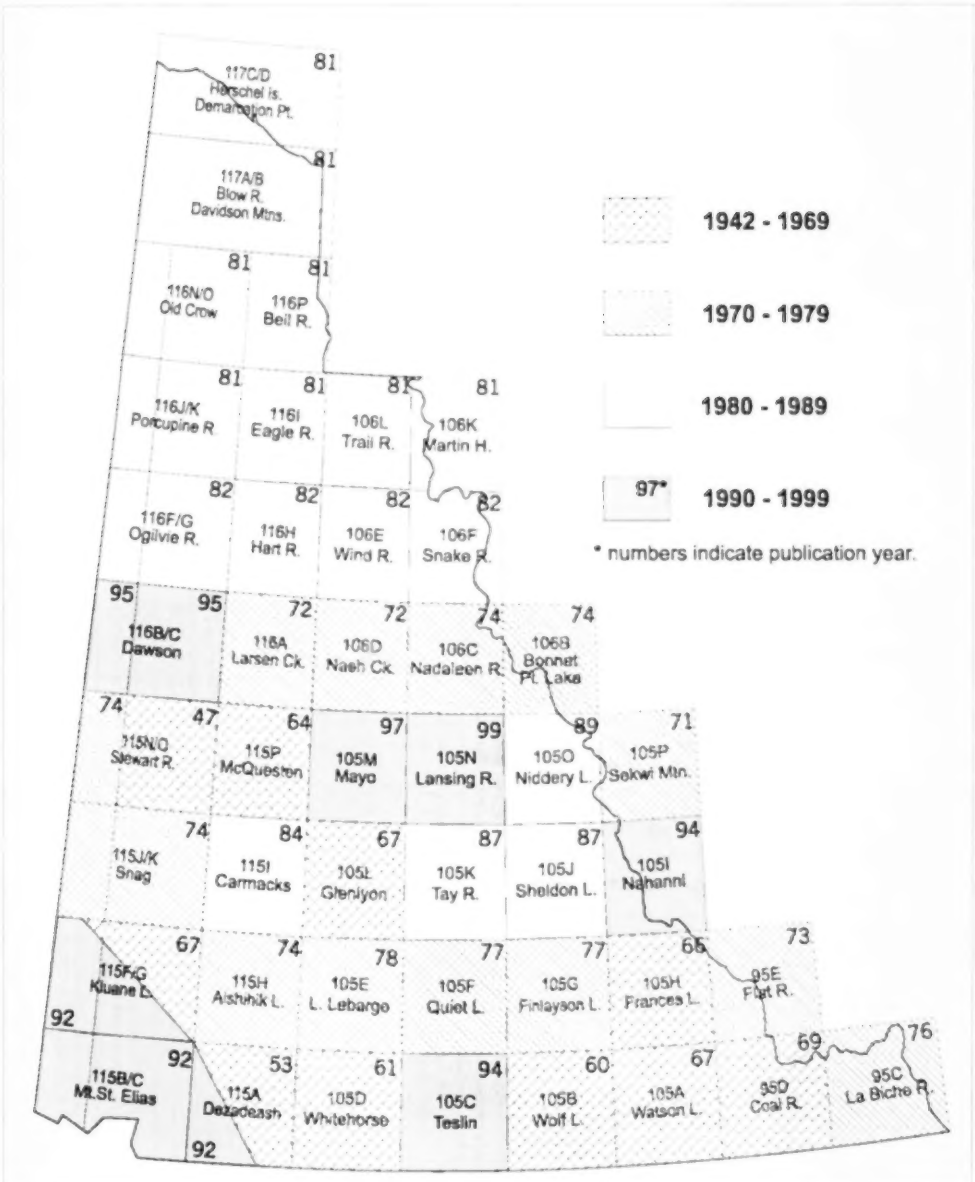

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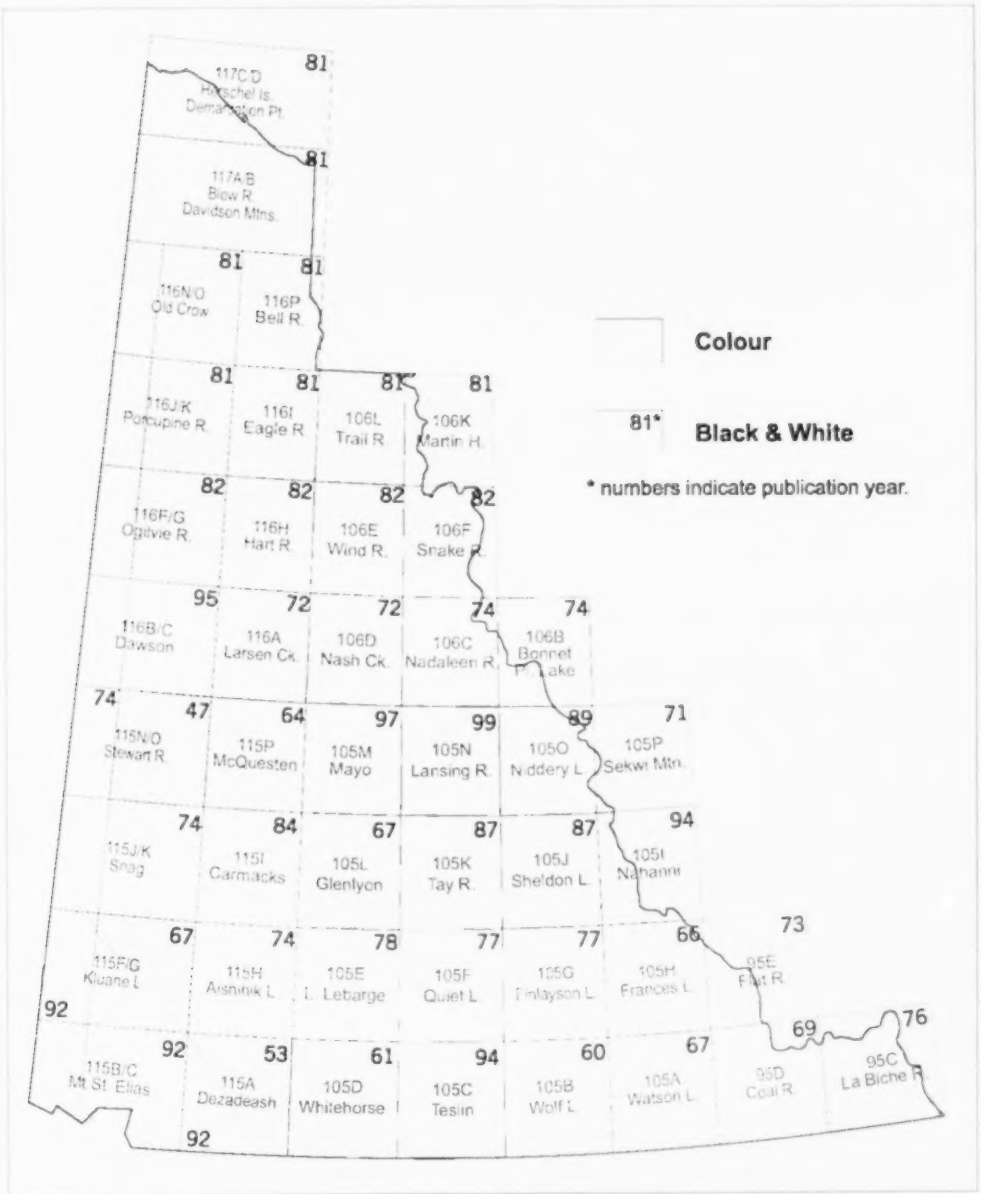


*Figure 2.*
*Most recent 1:250 000 scale map.*

- Whitehorse (105D): nearly half of the area has seen recent 1:50 000 scale mapping and with recent framework mapping in neighbouring Teslin map area, a modern compilation could be easily done. In fact, the compilation has largely been done for the Yukon Digital Geology of the Yukon project and all that really needs to be done is some work on the legend.
- Finlayson (105G/NE): Compilation of the ongoing 1:50 000 scale mapping in the 'Banana' (that area bounded on the northeast by the Finlayson Lake fault zone, and to the southwest by the Tintina Fault), with some new 1:250 000 scale mapping in the surrounding areas to the north and south would complete the documentation of this most understood part of Yukon Tanana Terrane. This would serve as the 'benchmark' against which less exposed and less understood areas of the terrane southwest of the Tintina Fault could be compared.

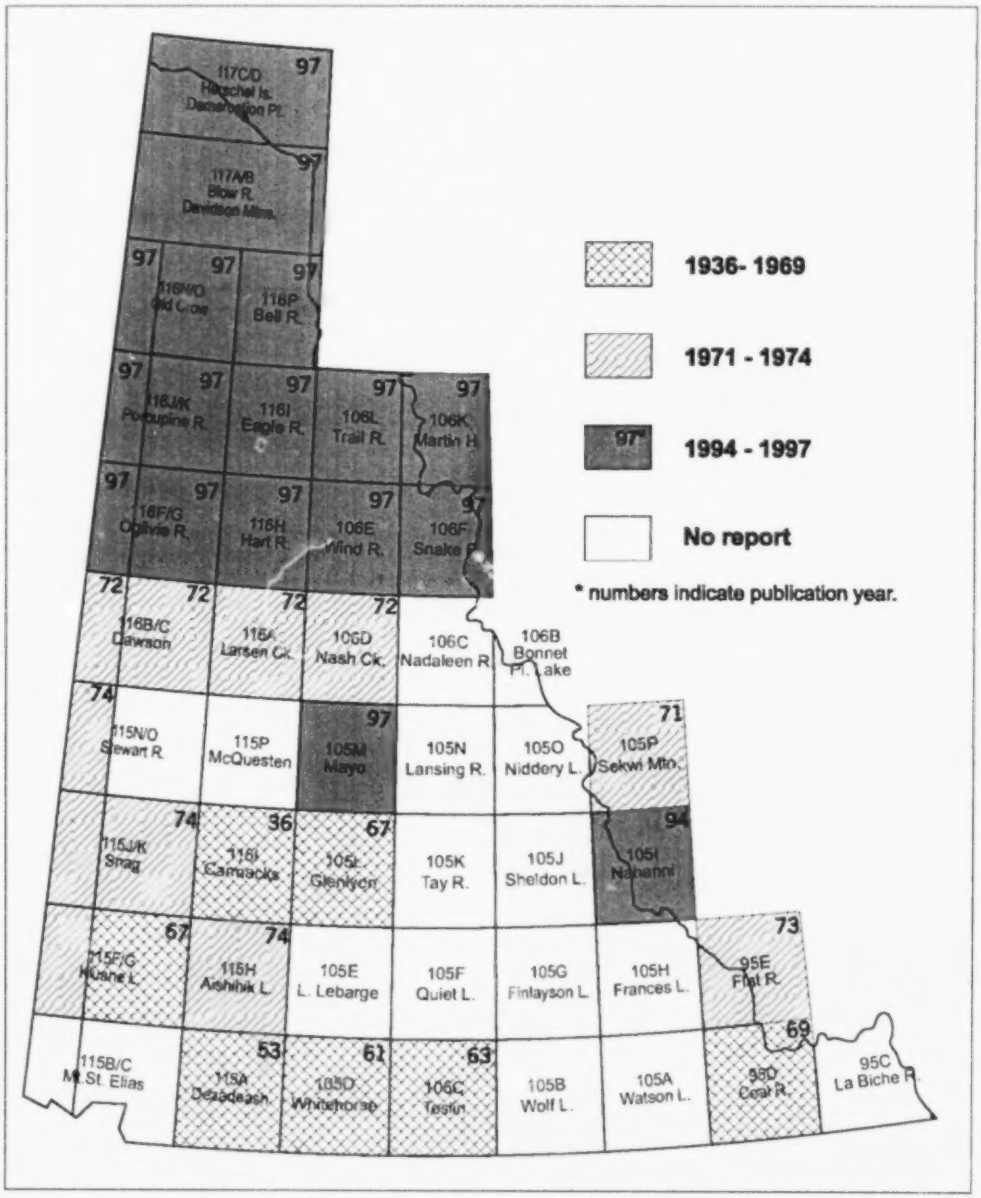


***Figure 3.*** *Most recent report.*

- Glenlyon (105L/SW): Ongoing 1:50 000 scale mapping from NW Glenlyon to Little Salmon Lake, will allow compilation of that part of Glenlyon (~ 1/3) underlain by Yukon-Tanana Terrane.
- Carmacks (115I): Some new 1:50 000 scale mapping to investigate the northwestward continuation of the Teslin Fault (see below), combined with recent detailed geological mapping and geophysical surveys, make Carmacks a good candidate for compilation.

## DETAILED BEDROCK MAPPING (1:50 000 SCALE)

The present state of detailed bedrock mapping is summarized in Figure 5. Since the Marsh Lake meeting, three bulletins on mapping that was done before Marsh Lake have been completed, and a fourth is nearly done. However, only two and a half new 1:50 000 scale map areas have been completed since that time. One and a half of these were identified as high priority at Marsh

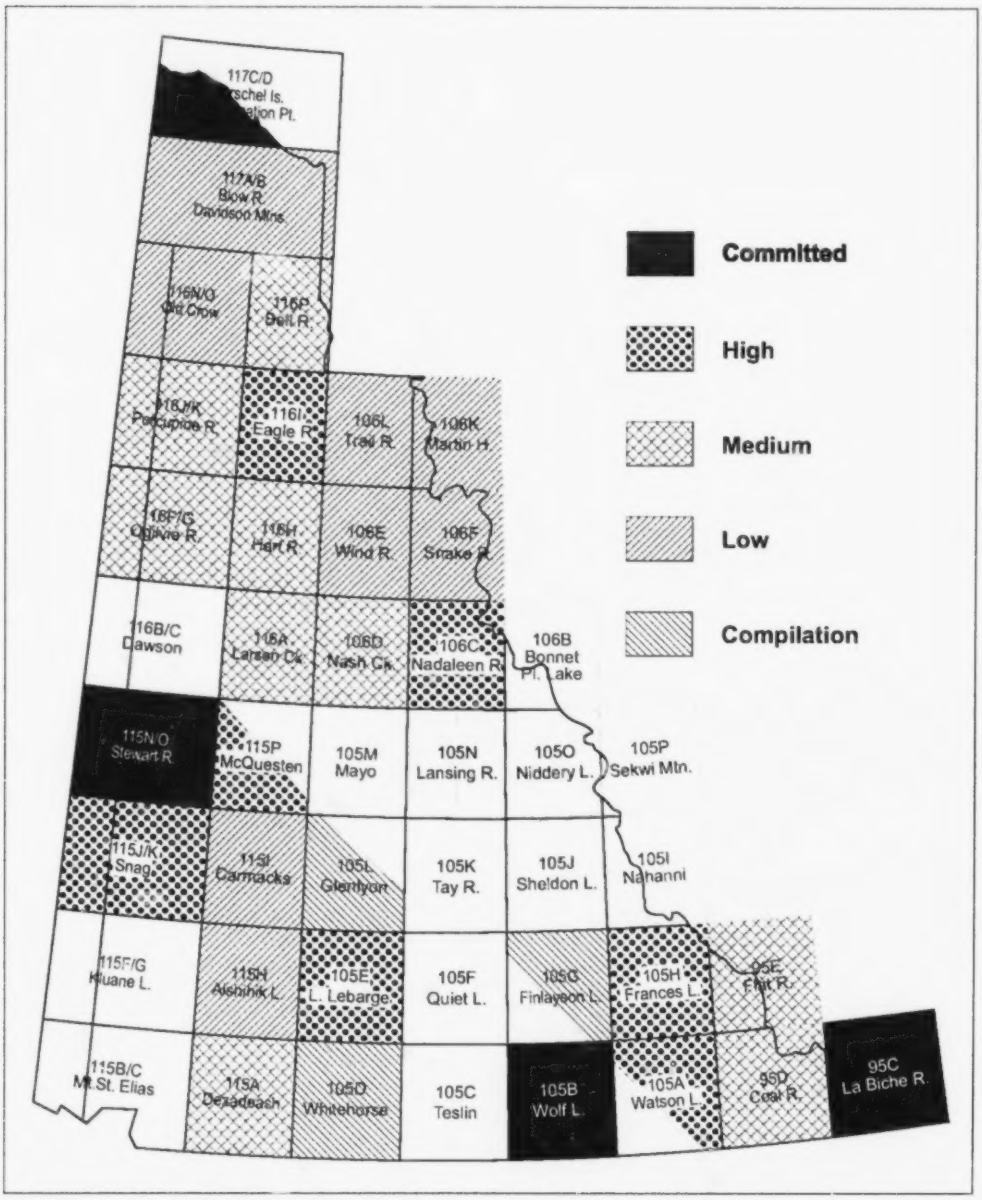


***Figure 4.***
*1:250 000 scale mapping priorities ('Hard-rock' and 'Soft rock' groups).*

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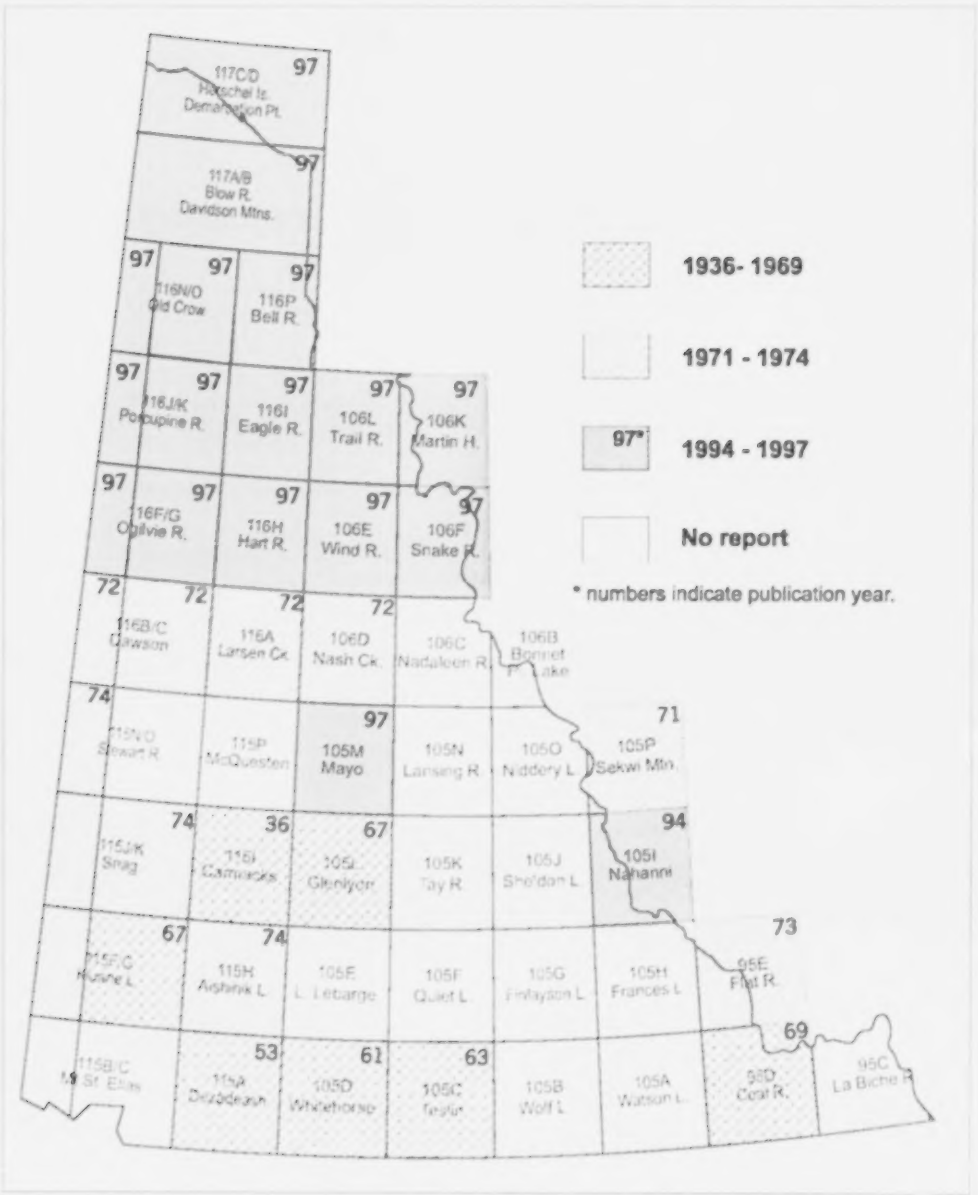


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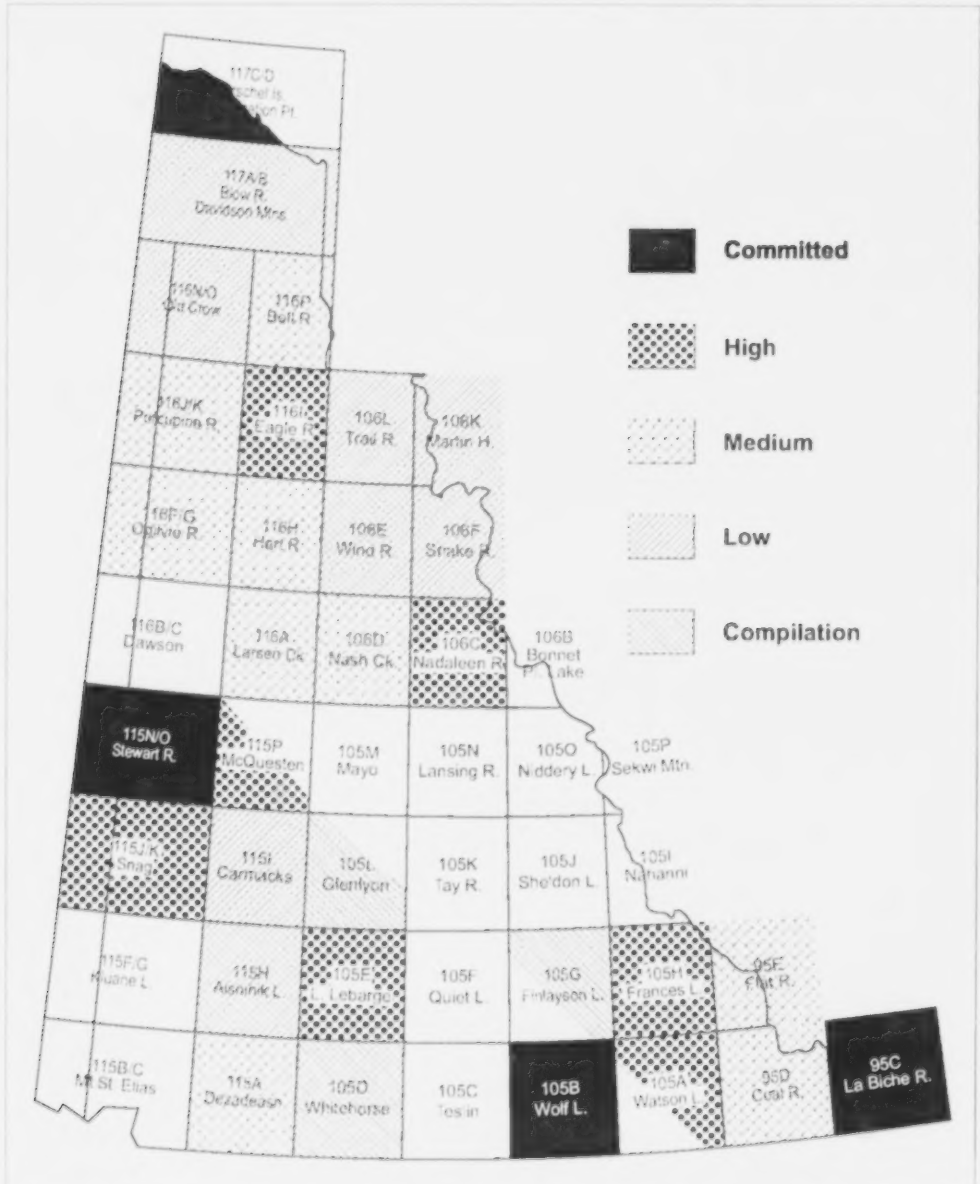


*Figure 4.*
*1:250 000 scale mapping priorities ('Hard rock' and 'Soft rock' groups).*

Lake (105G/7, 8 north half). Planned or in progress mapping includes work in the Anvil District (105K), work in Yukon-Tanana Terrane in Clenlyon (105L) and Finlayson(105G), and work in La Biche (95C) as part of the Central Foreland NATMAP project.

Priority areas for 1:50 000 scale mapping are summarized in Figure 6 and Table 4. The group took a belt by belt approach, identifying areas where critical scientific problems could be evaluated and areas of high, or potentially high, mineral potential. In assigning priority, we also considered whether local expertise existed and if it was important to develop it. We then compared these areas with areas that were identified at the Marsh Lake meeting and adjusted their ranking accordingly.

Overall, the current program of 1:50 000 scale mapping is weighted to Yukon-Tanana Terrane. The group felt that this weighting was still appropriate given the current focus of mineral exploration and the over abundance of outstanding scientific problems in this terrane.

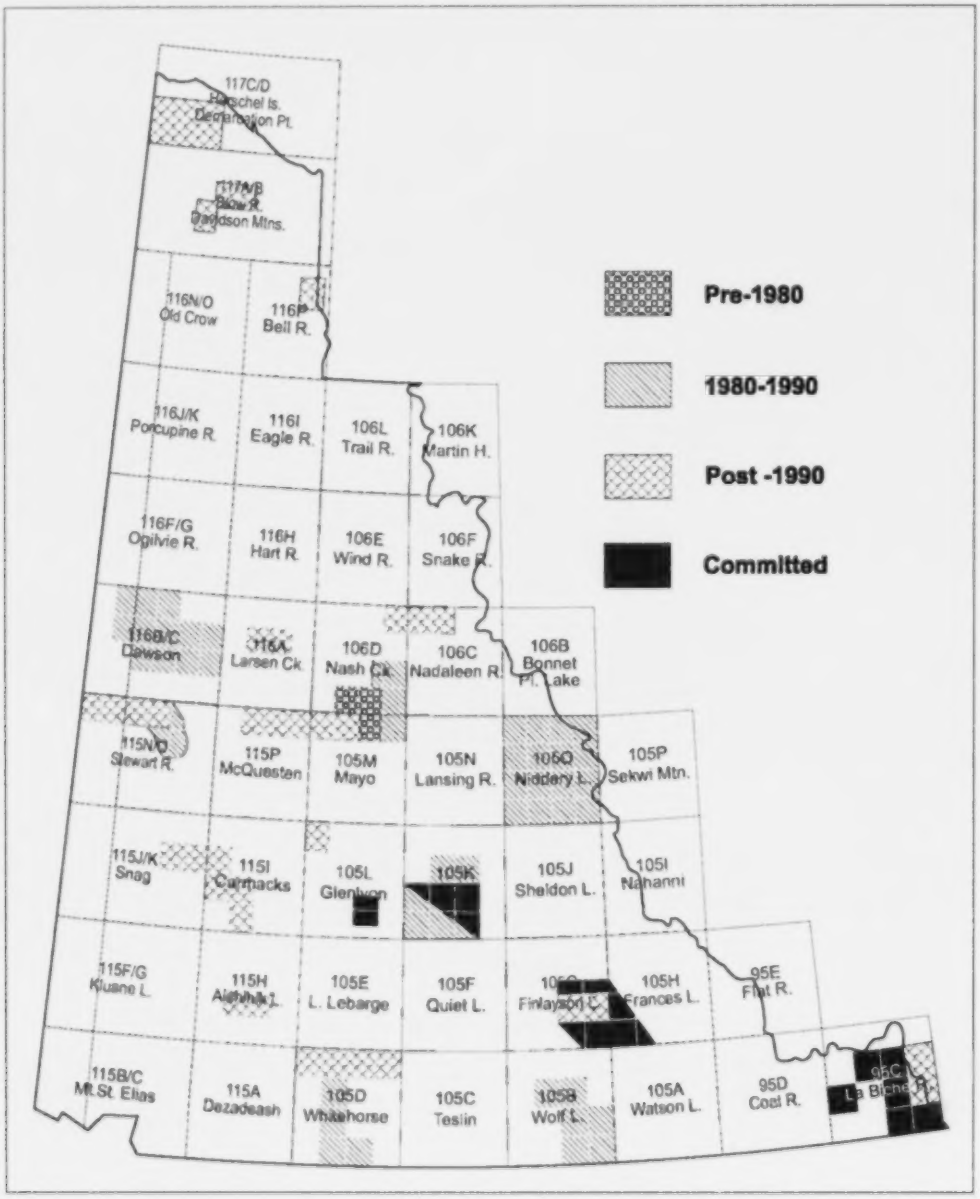


***Figure 5.*** *Geological maps completed or committed, 1:50 000 scale.*

### Insular Belt

The area southwest of the Denali Fault and north and east of Kluane Park retains the high and medium priority rankings from Marsh Lake for land use, mineral potential and public-interface issues, and, the added consideration that we currently have no local expertise in this area. High priority status was re-affirmed for the northwestern part of the area (115F/7,8,9,10,15,16) because it has high potential for magmatic Ni-Cu PGE deposits.

Mapping by DIAND near the Wellgreen Cu-Ni-PGE deposit was essentially completed in the 1980s but never published. The maps (parts of 115G/5,6,12) should be located and released as open files.

The remainder of the area (115A/2,3,6,11,13; 115B/16) lacks significant Ni-Cu-PGE potential and retains a medium ranking.

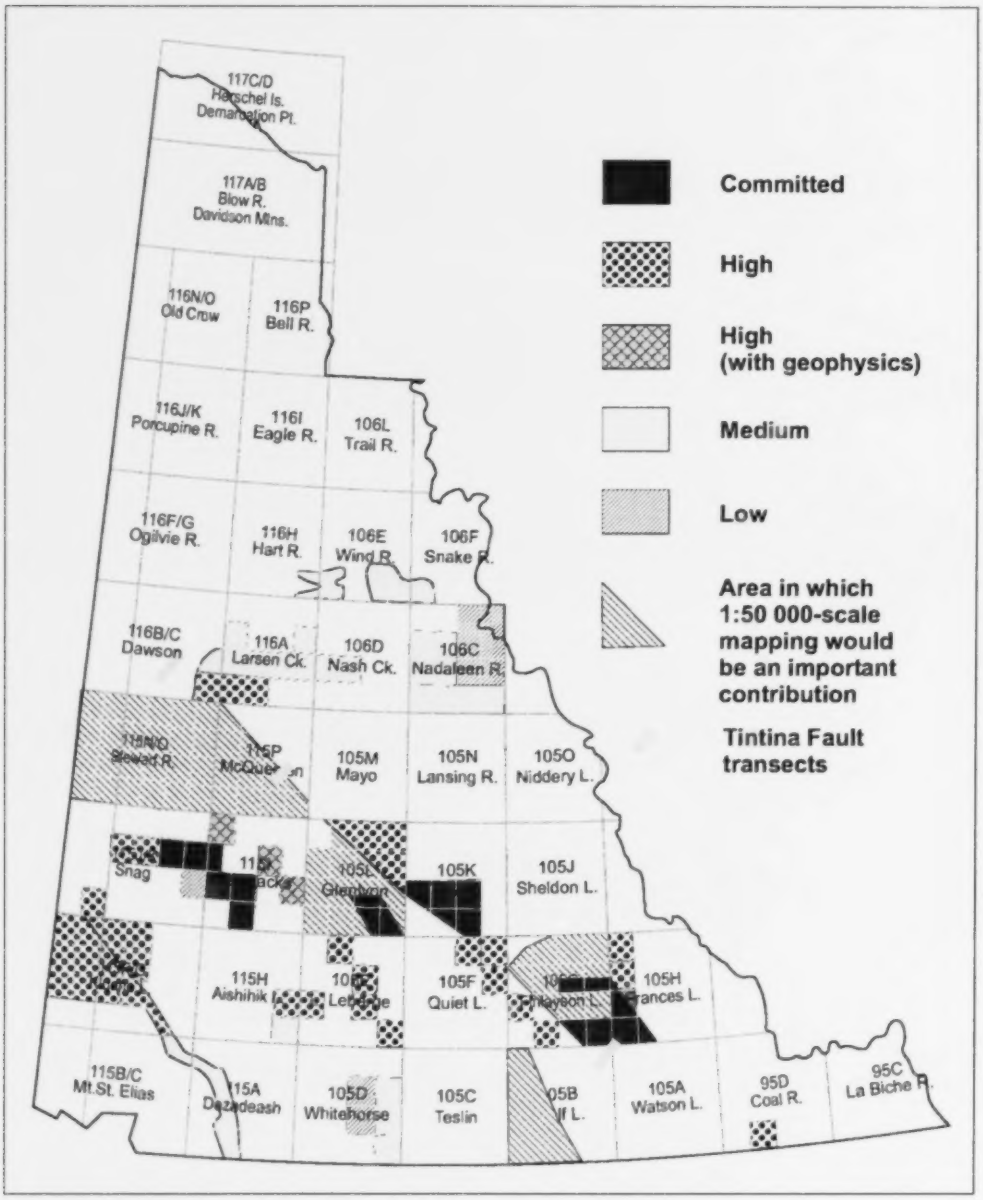


***Figure 6.*** *Mapping priorities ('Hard rock' group), 1:50 000 scale.*

Lake (105G/7, 8 north half). Planned or in progress mapping includes work in the Anvil District (105K), work in Yukon Tanana Terrane in Glenlyon (105L) and Finlayson(105G), and work in La Biche (95C) as part of the Central Foreland NATMAP project.

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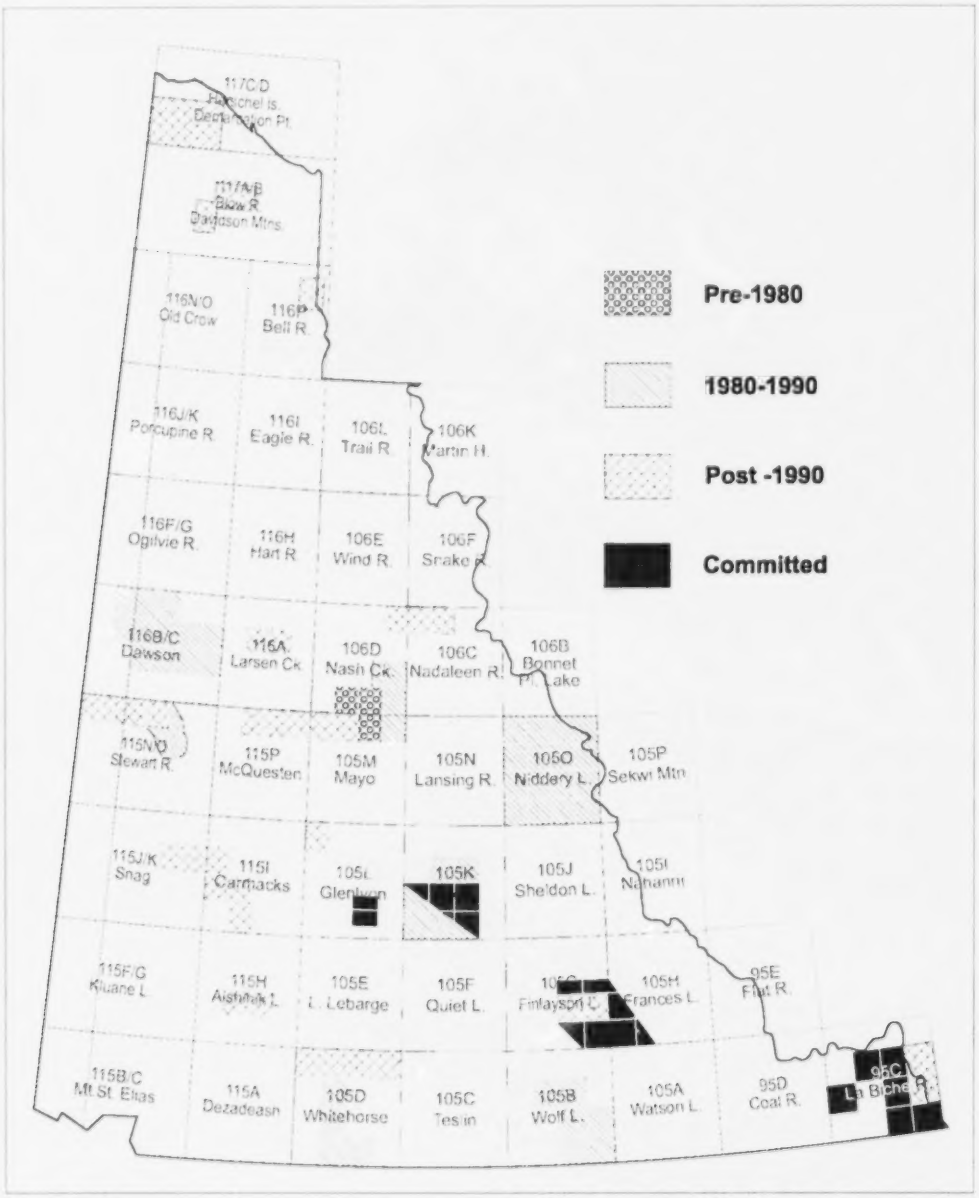


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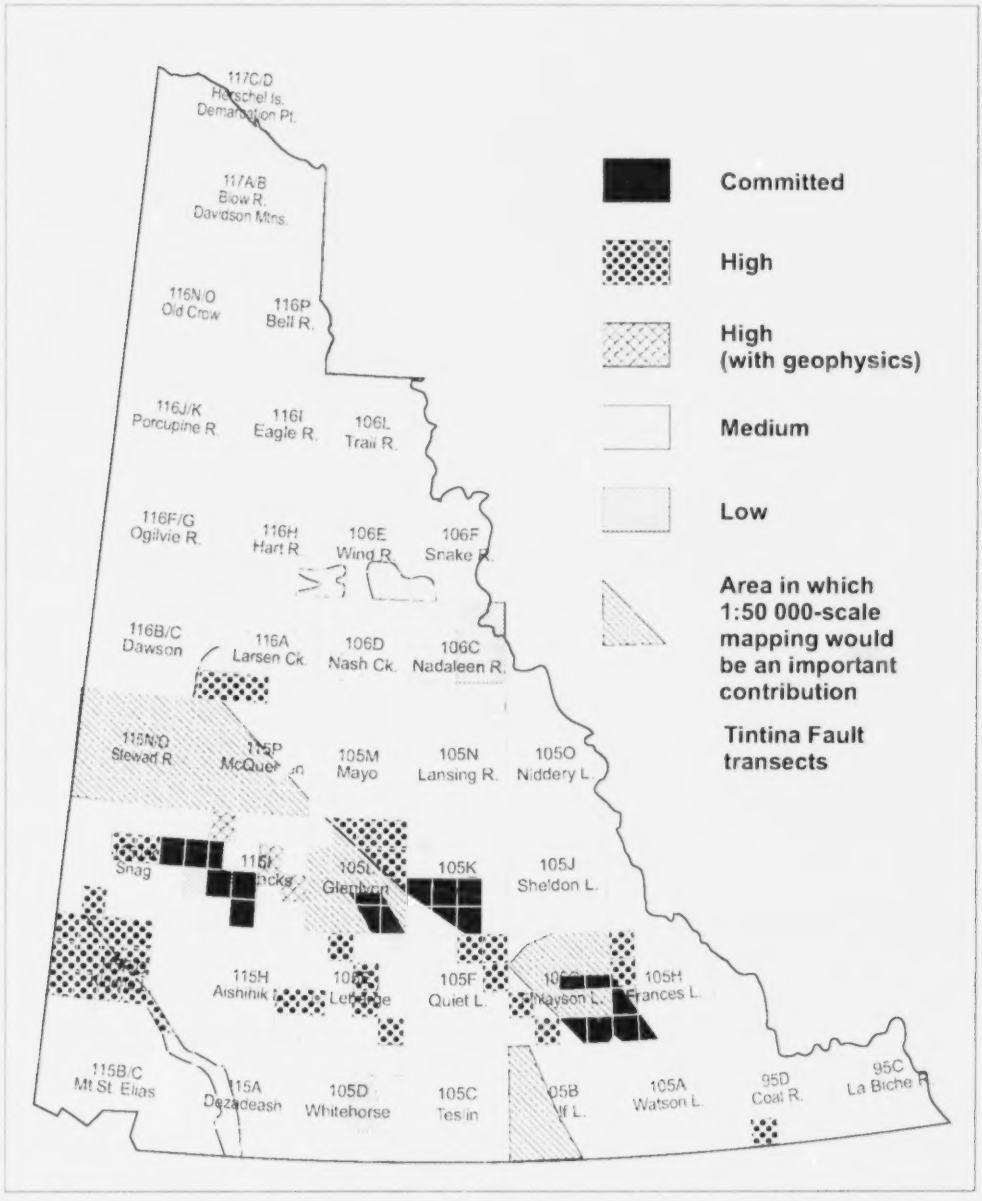


***Figure 6.*** *Mapping priorities ('Hard rock' group), 1:50 000 scale.*

### Windy-McKinley terrane

The area underlain by Windy McKinley terrane (parts of 115F/16; 115G/11,12,13, 14; 115K/1) was given high priority for same reasons as at Marsh Lake: it is the least understood part of the Yukon with poorly constrained but possibly high mineral potential. This study would be thematic and therefore not constrained totally by area.

### Intermontane Belt (Whitehorse Trough)

The group looked at scientific problems first and then checked against previous Marsh Lake rankings.

#### *Problems and considerations*

- Teslin Fault: The fault passes through 115I/8,10,13 and these areas were newly assigned a high priority ranking. (Note: The Marsh Lake Document recommended mapping in Carmacks be accompanied by geophysics. Although not discussed at the High Country Inn, this condition probably still pertains.)
- Semenof Hills block: These Upper Paleozoic(?) volcanic rocks are not well understood in terms of their terrane assignment, relationship to neighbouring terranes and mineral potential. Possible correlation to Yukon Tanana Terrane enhances their potential. Maps 105E/1,4,10,14 were assigned a high priority.
- Relationship of Whitehorse Trough to Yukon Tanana Terrane: The importance of this problem was also highlighted at Marsh Lake and two areas where this problem could be addressed (105E/5 and 115H/8) were assigned a high priority for this reason. This area is also underlain by the coal bearing strata at Division Mountain.
- Jurassic alkalic intrusions and Cu Au porphyries: The recent confirmation of the potential of Jurassic alkalic intrusions to host BC style Cu Au porphyry deposits elevates the importance of mapping in areas underlain by these intrusions. 105E/1 was deemed to be high priority on this basis.
- Stikine–Cache Creek terrane relationship: This problem was given a high priority at Marsh Lake and map 105D/1 was then accorded a high priority as a place to examine it. However, the current group deemed this problem to be less important than the above named problems and considerations and 105D/1 was demoted to medium priority and linked to a Whitehorse compilation.

### Yukon-Tanana Terrane

As previously mentioned, the group consensus was that Yukon Tanana Terrane continues to be highest priority for work at both 1:250 000 and 1:50 000 scales. With this in mind, any area that has been identified as a high priority for framework mapping or compilation may have within them areas that are suitable for 1:50 000 scale mapping (Stewart River, McQuesten, Snag, Finlayson Lake, Glenlyon, Carmacks, Wolf Lake, Frances Lake).

These areas are also considered high priority for 1:50 000 scale mapping. The map areas in Carmacks covered by the Dawson Range geophysical survey are still considered to be high priority, especially in light of the Pogo discovery. Also in light of the Pogo discovery, the Moosehorn area was deemed to be high priority.

### Tintina Fault

This 'area' was identified as important for its gold potential and because of the uncertainty about its displacement history. The 'area' is best addressed through transects, rather than mapping areas, simply because of exposure considerations. The most promising transects are northwest of Dawson, in McQuesten map area (Crooked Creek) and in the Pelly Mountains (Black River in NE Watson Lake/SE Finlayson Lake). These transects could be done in conjunction with other mapping projects, e.g., McQuesten SW framework mapping or 1:50 000 scale mapping in the St. Cyr assemblage (see below).

### Selwyn Basin/Pelly Cassiar Platform

#### *Problems and considerations*

- St. Cyr assemblage: This assemblage is made up of pre-Mississippian rocks about which little is known. They apparently don't resemble either Selwyn Basin or Cassiar Platform and may represent rocks juxtaposed with these elements during Devonian faulting. Areas underlain by the St. Cyr assemblage (105F/9,15,16; 105G/2,5) were given high priority at Marsh Lake. They are still considered to be high priority for stratigraphic reasons as well as economic.
- Tombstone intrusions and host rocks, western Selwyn Basin (Larsen/Nash): Several 1:50 000 scale map areas were given high priority at Marsh Lake. Since that time, geophysical surveys have been flown over part of this area; the group thought that the areas with geophysical coverage should be given high priority for new mapping (116A/3,4; 116B/1,4) and the others should be downgraded to medium priority (116A/5 8,12).
- Northwestward continuation of Anvil stratigraphy (NE Glenlyon, 105I/9,14,15,16): This area is characterized by vintage mapping, highly prospective yet poorly understood stratigraphy. It is considered to be high priority.
- The northern part of Finlayson Lake map area (105G/9,16) and the adjacent part of western Frances Lake map area (105H/12,13) is underlain by rocks that could be either Yukon Tanana Terrane or Selwyn Basin. The contact between Yukon Tanana Terrane and North America (Finlayson Lake fault zone) also goes through this area. A high priority is given to understanding this area better because these are fundamental structural and stratigraphic problems and there is potential in this area for both zinc and gold mineralization.

- SEDEX potential associated with northeast striking platform to basin transition in southeastern Yukon (Coal River map area, 95D) makes this area and especially 95D/3, near the Mel Zn Pb Ba deposit, important (high priority). Recent advances in stratigraphic understanding in other areas will allow for new interpretations in this poorly exposed area. Since the 1969 mapping, exposure has been enhanced to a certain degree by logging road construction.
- Structural controls on gold silver mineralization, southern Niddery Lake (105O/1-4): Owing to the recent vintage of both 1:50 000 and 1:250 000 scale mapping, it was thought that this study be given high priority but as a mineral deposits study.

### Wernecke-Ogilvie Mountains

Areas in the Wernecke Mountains (parts of 116H, 106E) that were thought to be high priority at Marsh Lake because they included poorly understood Proterozoic rocks were demoted to medium priority in light of the above new high priority areas.

# 'SOFT-ROCK' BEDROCK MAPPING

The bedrock mapping ('Soft rock') subgroup consisted of co-facilitators Larry Lane (GSC Calgary) and Lee Pigage (YGP), and participants Shirley Abercrombie and Julie Hunt (YGP), Tim Bird, Rob Carne (Archer Cathro and Associates (1981) Ltd.), and Derek Rhodes (Cominco Ltd.). The group looked at the bedrock geology mapping priorities from a soft rock perspective. Primary economic interests represented by the group included oil and gas, coal, stratiform shale hosted sulphide (SEDEX) deposits, and Mississippi Valley type deposits. Soft rock oil and gas interests are centred on the Mesozoic sedimentary basins and the Foreland Fold and Thrust belt. Coal interests are also focused on the Mesozoic basins, particularly the Whitehorse Trough. Overlapping hard rock interests are primarily in southeast Yukon along the transition from carbonate dominated platform in the east to shale dominated Selwyn Basin in the west.

Economic factors strongly influenced setting of priorities for geological mapping. YTG is looking to hold lease sales for oil and gas exploration in the near future; areas encompassed by the lease sales were given a higher rank. Conversely, areas with land withdrawals from future development were downgraded, although geological questions remain.

The discussion group overall felt that Yukon geology was not yet advanced enough nor the geology complex enough in most sedimentary basins to support detailed problem oriented studies covering small areas. The base level of geological information still requires area mapping as the primary contribution. Framework geological mapping at 1:250 000 scale is useful mainly for regional basin wide geology work. Detailed geological mapping at 1:50 000 scale is useful on a project or specific well target basis, and is also useful in foreland settings to adequately differentiate closely spaced structures and stratigraphy.

## FRAMEWORK BEDROCK MAPPING (1:250 000 SCALE)

The 1:250 000 scale map sheets considered to be high and medium priority for future framework geological mapping by the discussion group are shown in Figure 4 with those identified by the 'Hard Rock' Group and summarized in Table 3. Three areas (northern Yukon, southeast Yukon, and Whitehorse Trough) were identified as high and medium priority areas. Each area is discussed separately below.

### Northern Yukon

The 1995 Marsh Lake Document identified areas 117A D as high priority for upgrading. Since then 117C and 117D have new geology maps in final preparation and are therefore no longer a priority. Areas 117A and 117B have been reduced to a medium to low priority because of land withdrawals from future development.

With imminent oil and gas lease sales, northern Yukon has an increased importance to oil and gas interests. Areas 116F,G,H,I,J,K,P and 106E,F,K,L require upgrading, largely because of problems correlating previous surface geology mapping with subsurface well and seismic data.

The Old Crow areas (116O,N) are regarded as low priority for 1:250 000 mapping overall because exposure is poor, and mineral potential is considered low. Due to poor exposure, the northern half of both areas are probably adequately mapped at present. Future detailed mapping in parts of the south may lead to recompilation, but it is less critical to potential industry involvement than adjacent areas. There is some intrusion related mineralization around Old Crow Batholith.

Map sheet 116I has the highest priority. Upgrading could be accomplished with minimal fieldwork by incorporating recent subsurface information and new stratigraphic studies. Revision of sheet 116I would provide a strong framework for upgrading and reinterpretation of nearby areas.

Sheets 116P (south) and 116J/K would require a similar amount of work to upgrade by incorporating subsurface data. In contrast, sheets 116P (north), 116H, and 116F/G would require major re mapping of selected areas.

Sheets 106L, 106K, 106E, and 106F were rated medium to low priority. They are in the Peel Plateau where the geology is less complex, and are more remote from existing transportation infrastructure. The petroleum industry sees them as less immediate targets, and their economic potential for oil and gas exploration has been reduced accordingly.

### Southeast Yukon

Oil and gas participants in the discussion group identified map sheets 95C, 95D, and 95E as having a high priority. Existing maps in this area date from 1976 or earlier. The Marsh Lake Document identified these areas as medium to low priority. They were upgraded to medium and high priority because of ongoing oil and gas development and exploration, and poor correlation between subsurface and surface. The same sheets were of interest to hard rock participants because of their potential for Mississippi Valley type (MVT) deposits.

Hard rock participants in the discussion group gave a medium to high priority to sheets 105A, 105B, 105G, and 105H, based on the absence of recent mapping, and poor geologic understanding in areas of high SEDEX potential. The Marsh Lake Document assigned high to medium priority to 105A, 105B, and 105H, but sheet 105G was not previously rated. Its inclusion here is based on recent VMS discoveries and results of detailed geology mapping ongoing in the adjacent Finlayson Lake area.

Fieldwork began in 1999 in sheet 105B and is planned for 2000 in 95C. Both are part of NATMAP projects.

### Whitehorse Trough

Whitehorse Trough (sheets 105D, 105E, and 115H (east edge)) was identified as a high priority by both coal and oil and gas participants in the discussion group. Both parties stressed the requirement for a revised stratigraphic framework for the Jurassic-Cretaceous formations within the map sheets. The Jurassic-Cretaceous section has a complicated depositional history with numerous local facies changes, which have not been documented adequately. Extensive thermal maturation, palynology, micropaleontology, and organic geochemistry studies were considered to be an essential component of the proposed fieldwork.

The discussion group felt that 105D needs mainly compilation work because recent geological mapping at 1:50 000 scale had been completed. For 105E and 115H, it was felt that the proposed geology work should consist largely of a series of spaced stratigraphic columns with age dating control rather than strictly area lithologic coverage.

## DETAILED BEDROCK MAPPING (1:50 000 SCALE)

Figure 7 and Table 4 indicates the high priority areas for 1:50 000 scale mapping as identified by the discussion group. These priorities were generally tied to the 1:250 000 scale priorities with some exceptions as noted below. This is because recompiling of some 1:250 000 sheets will first require extensive 1:50 000 scale mapping of structurally complex areas. Accordingly, the detailed mapping priorities are generally confined to the 1:250 000 scale map areas that were identified as medium to high priority. The soft rock group did not discuss a relative ranking among the high priority 1:50 000 scale sheets. In most cases, these areas were identified as prerequisites to production of adequate 1:250 000 scale maps.

### North Yukon

In northern Yukon, map sheets 116F/1,8,9,10,15,16; 116G/4,5, 12,13; 116O/2,3,4,7,8 and 116P/5 12,15 and 117B/2,7 were given high priority. Except for the 116O sheets, these are identified as structurally complex areas that require detailed work in order to compile adequate 1:250 000 scale maps. The 116O sheets are significant in establishing the structural continuity through the Dave Lord Mountains, and in constraining models for the adjacent areas. In addition, detailed mapping in 116F and 116G include parts of Kandik Basin which is considered prospective. Future detailed mapping in 116P may be extended northward into the structurally complex northern Richardson Mountains along the eastern edge of 117A.

### Southeast Yukon

In southeast Yukon, the group cited maps 95C/5,11 as high priority. These areas, as well as 95C/1,2,7,8,10 are committed as part of the Central Foreland NATMAP Project with field work scheduled to start in 2000. Due to advanced work, 95C/8,9 are available as Open File maps. Areas 105H/4,5; 105G/5,6,9,10,15,16 and 105F/8 were identified as high priority map sheets by the hard rock participants. The ranking was based on extensions of the present field work being completed in the Finlayson Lake area by Yukon Geology Program and on the need for an increased understanding of the geology at the southern end of Selwyn Basin.

### Whitehorse Trough

Map sheets 105D/7,10, 105E/5,6,12,13, 105I/4, 115H/8 and 115H were identified as high priority 1:50 000 scale map sheets in the Whitehorse Trough area. Detailed 1:50 000 scale geological mapping in the proposed high priority map sheets would provide stratigraphic information for proposed studies within Whitehorse Trough as mentioned above in the 1:250 000 scale framework geology mapping section. The strip of 1:50 000 scale map sheets in 105E, 105L, 115H, and 115I was selected by the coal participants because of proximity to existing roads and power grid lines; oil and gas participants also expressed an interest in these map sheets.

### Other considerations

- A need was expressed for 'corridor' surficial geology studies to be used as baseline information for possible infrastructure development associated with exploration and/or production in areas prospective for future development. The surficial geology studies should identify areas of permafrost and potential road building material ('borrow pits').
- The RGS (Regional Stream Geochemical Survey) database should be completed in the 1:250 000 scale map sheet 95C. Three justifications were forwarded for completion:

  1) exploration interests from both MVT and oil and gas perspectives,

  2) requirements for baseline information in an area of exploration and possible production,

  3) a NATMAP project is scheduled for fieldwork in that area starting in 2000; logistical support could be shared between the RGS and NATMAP projects.

- Resource assessment by YGP using YGP funds was not really a concern for oil and gas participants. In fact government funded hydrocarbon potential studies in sedimentary basins are expected by industry as an integral part of the leasing and land acquisition process undertaken during oil and gas exploration.
- The participants suggested that private companies should be polled for possibly contributing proprietary data into the public domain in areas selected for future geological mapping. Oil companies, in particular, may have useful proprietary geophysical, paleontological and geological information.

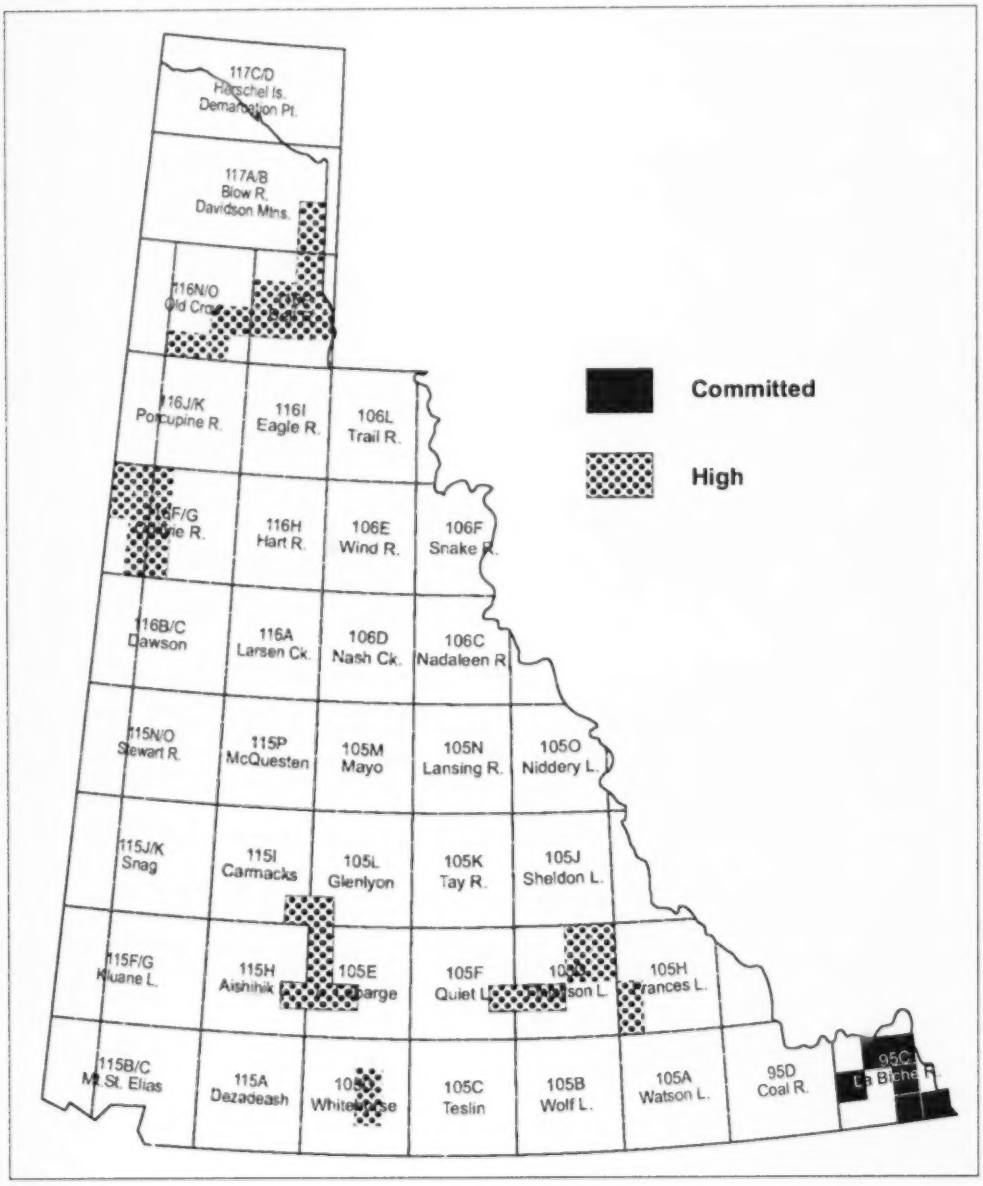


***Figure 7.*** *Mapping priorities ('soft rock' group), 1:50 000 scale .*

# SURFICIAL MAPPING AND PLACER RESEARCH PROGRAM

The comments and recommendations below come from discussions among the following participants: William LeBarge (YGP), Grant Abbott (YGP), Steve Morison (Gartner Lee Ltd.), Fran Hein (Alberta Geological Survey/University of Calgary), Mike MacDougall (Klondike Placer Miners Association), Stuart Schmidt (Klondike Placer Miners Association), Jim Christie (Gimlex Placer Mines Ltd.), Lionel Jackson (Terrain Sciences Division, GSC, Vancouver), Jeff Bond (YGP) and Grant Lowey (YGP).

Other than framework mapping, much of the discussion in this session centred on the question of focus and direction for placer deposit research rather than prioritization of specific map areas. This difference from the bedrock mapping sessions stems from the challenges that the Yukon Geology Program has faced in designing and implementing effective placer research, primarily as a result of factors such as the localized nature and limited exposure of most placer deposits.

## UPDATE

The group reviewed the status of surficial mapping and placer geological studies in the Yukon (Figure 8). The following items had been completed since the Marsh Lake geoscience planning meeting in 1995:

1. Mayo area 1:50 000 scale surficial mapping and placer studies of 115P/15, 115P/16, 105M/13, 105M/14, 106D/1, 116A/1 by J. Bond, W. LeBarge, F. Hein, L. Weston and T. Allen.
2. Stewart River 1:50 000 scale surficial mapping and placer studies of 115O/13, 115O/12, 115NO/9 by S. Morison, C. Mougeot and L. Walton.
3. 1:250 000 scale surficial geology map of 116B/C Dawson by A. Duk-Rodkin (GSC).
4. 1:250 000 scale surficial geology map of 115P McQuesten by J. Bond (under review).
5. Four 1:100 000 scale surficial geology maps of 115I Carmacks by L. Jackson (GSC).
6. 1:250 000 scale surficial geology map of 105C Teslin by R. Klassen (GSC) and S. Morison (Gartner Lee Ltd.).

Items 1 (Mayo) and 2 (Stewart River) were a direct result of March Lake recommendations. In addition, surficial geology mapping of the Stewart River map (115N/O) was also recommended and began in 1999 as part of the Ancient Continental Margin NATMAP program.

Projects, which were recommended at Marsh Lake but not enacted, include:

1. Surficial geology mapping/Placer potential study of northern half of 115H map sheet.
2. Surficial geology mapping/Placer potential study of northeastern corner of Mayo study area (106D2).

## 1999 RECOMMENDATIONS

The following six broad recommendations were agreed upon by the committee:

***1. Regional mapping***

New and updated 1:250 000 scale surficial geology mapping should be conducted in the following areas (Figure 9), in order of priority:

- Snag (115J/K) as a continuation of the mapping in Stewart River map area and as a tie in between Dawson and Carmacks for regional coverage; priorities regarding placer potential, Quaternary geology and surficial stratigraphy.
- Whitehorse – Laberge – Dezadeash (105D, 105E, 115A); priorities concerning surficial geology and land use issues. Open files exist but need updating and compilation of new data.
- Watson Lake – Wolf Lake (105A,B) to tie in with Jennings River in BC – part of GSC mapping in area; collaborative with BCGS.
- Lower priorities are those areas where mapping is outdated, only at a reconnaissance level, or non existent. These include: 95C, D; 105O; 106E, F; 116H.

***2. Water and mining technology research***

Due to the upcoming Yukon Placer Authorization (YPA) Review in 2001 and other issues such as Mining Land Use and Environmental Assessment processes, support for water quality and mining technology research is important and should continue. The current program, begun in 1998 and jointly operated by Yukon Geology Program/DIAND Placer Inspection Division and Okanagan University, received support. It was agreed that the following drainages should be part of the study: Nansen Creek, Big Creek, Sixty Mile River above 12 Mile Creek, Duncan Creek and Clear Creek. The main objectives of this study would be to gather background water and deposit grain size data, test the sediment diffusion model used in the YPA, and integrate new data with the available grain size data in the Placer MINFILE Database.

### *3. Industry Liaison*

The need for placer deposit studies and research was confirmed. However, Yukon Geology Program staff should increase liaison and contact with placer miners to better convey the results of ongoing work. This would be accomplished by:

- Increasing the amount and frequency of on site mine visits during the mining season.
- Describing mine site geomorphology and creating section descriptions for the use of miners and for inclusion into the Placer MINFILE Database.
- Creating simplified geology and geomorphology maps for miners.
- Presenting placer short courses as part of Geoscience Forum or Gold Show.

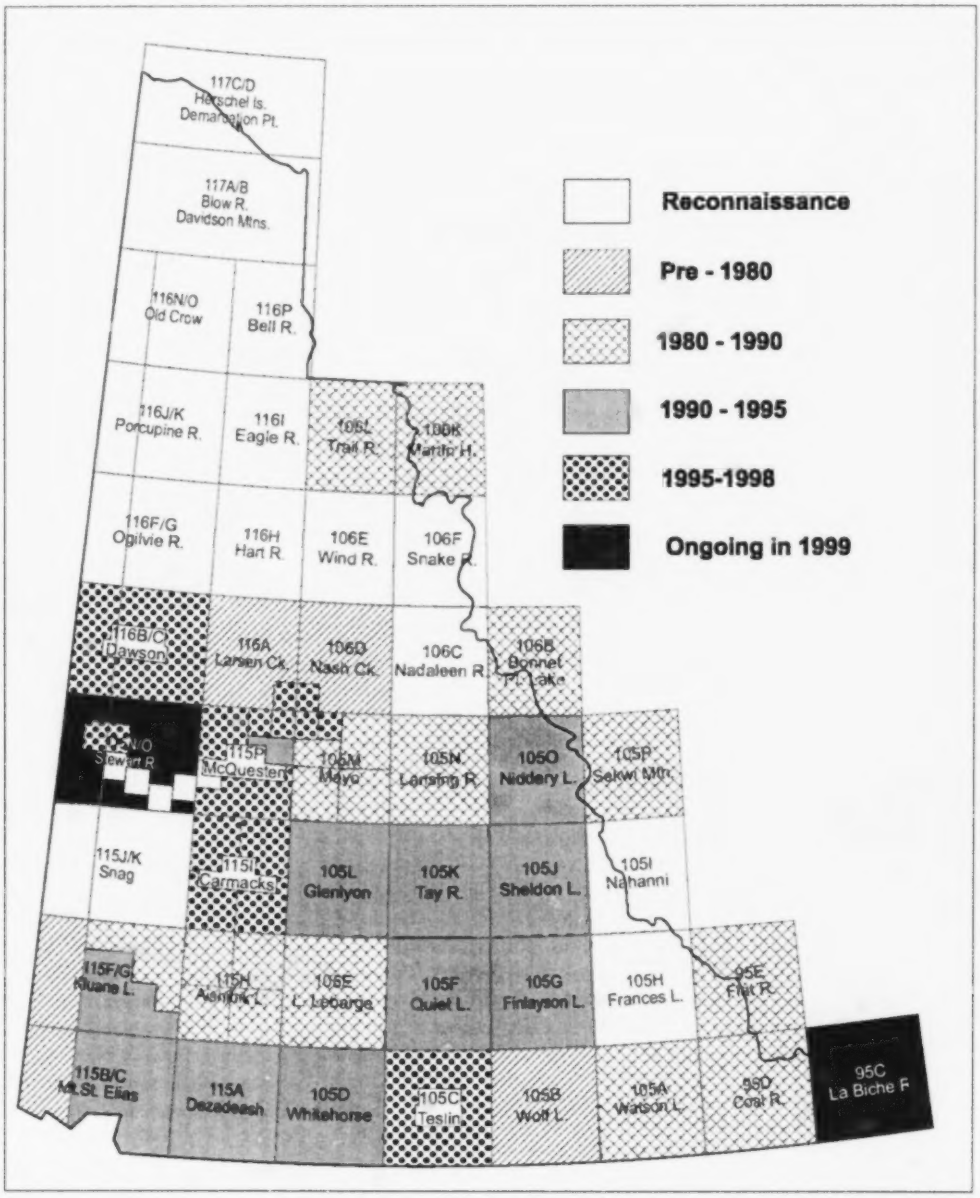


***Figure 8.*** *Surficial geological maps completed.*

### *4. Placer MINFILE Database*

This database holds detailed information on placer deposits and mines including: sedimentology, stratigraphy, grain size, heavy minerals, gold fineness, production and mining history. It is currently not in a form that is publicly useable. It was agreed that there is a need to dedicate time, money and people to develop the database to a point where it is searchable in a user-friendly way, accessible and available to the public, industry and government stakeholders. Ongoing updates and maintenance of the Placer MINFILE is also important, particularly after site visits by geologists to the different placer mines and districts.

### *5. Unified Placer Scheme*

There is a need to take a unified approach in the sampling, description and mapping of placer and surficial sediments in the Yukon. A scheme developed by Grant Lowey, Bill LeBarge, and Lionel Jackson will be tested as part of the Stewart River NATMAP project. Aspects that will be considered include heavy mineral

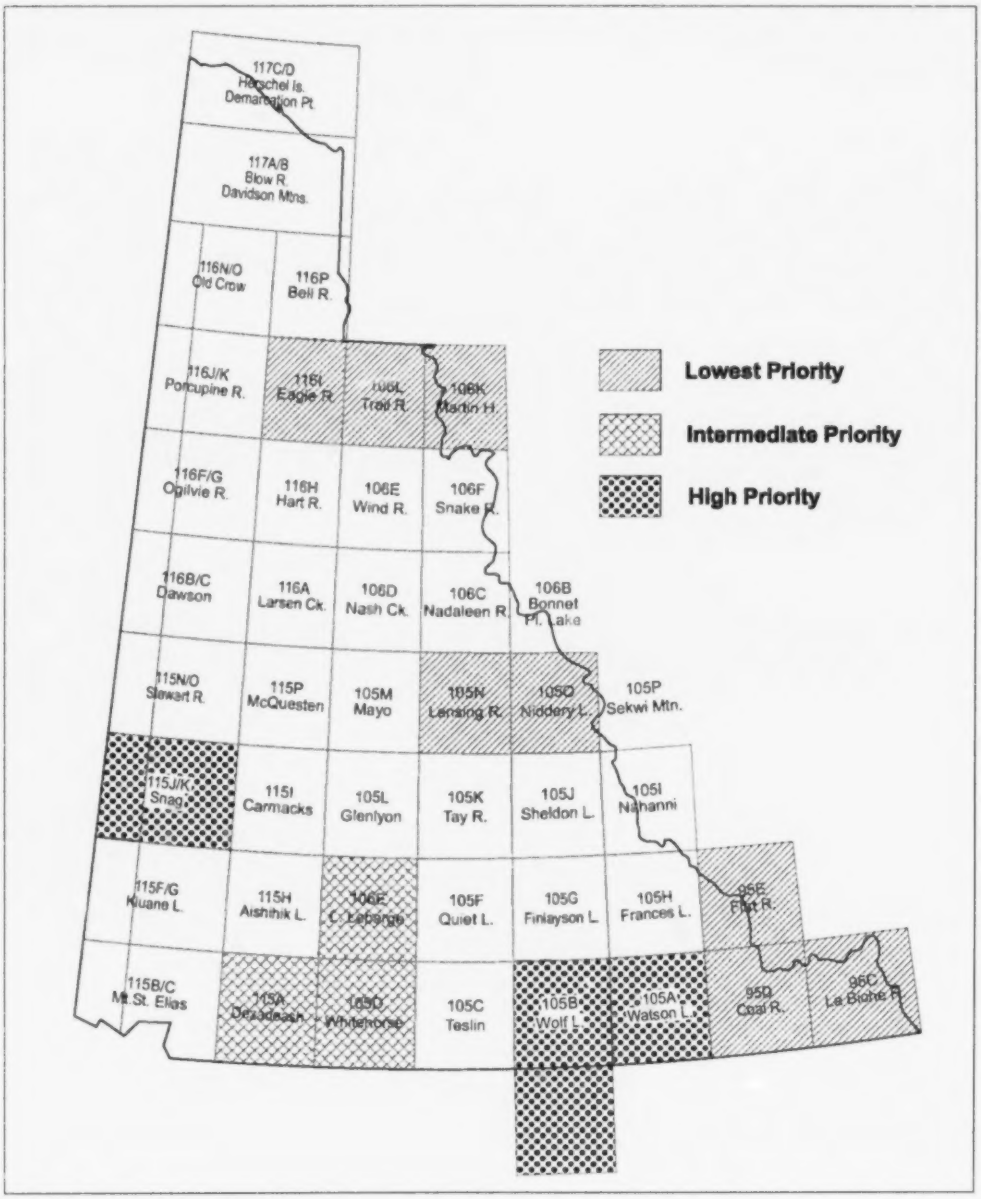


***Figure 9.*** *Proposed surficial geological mapping.*

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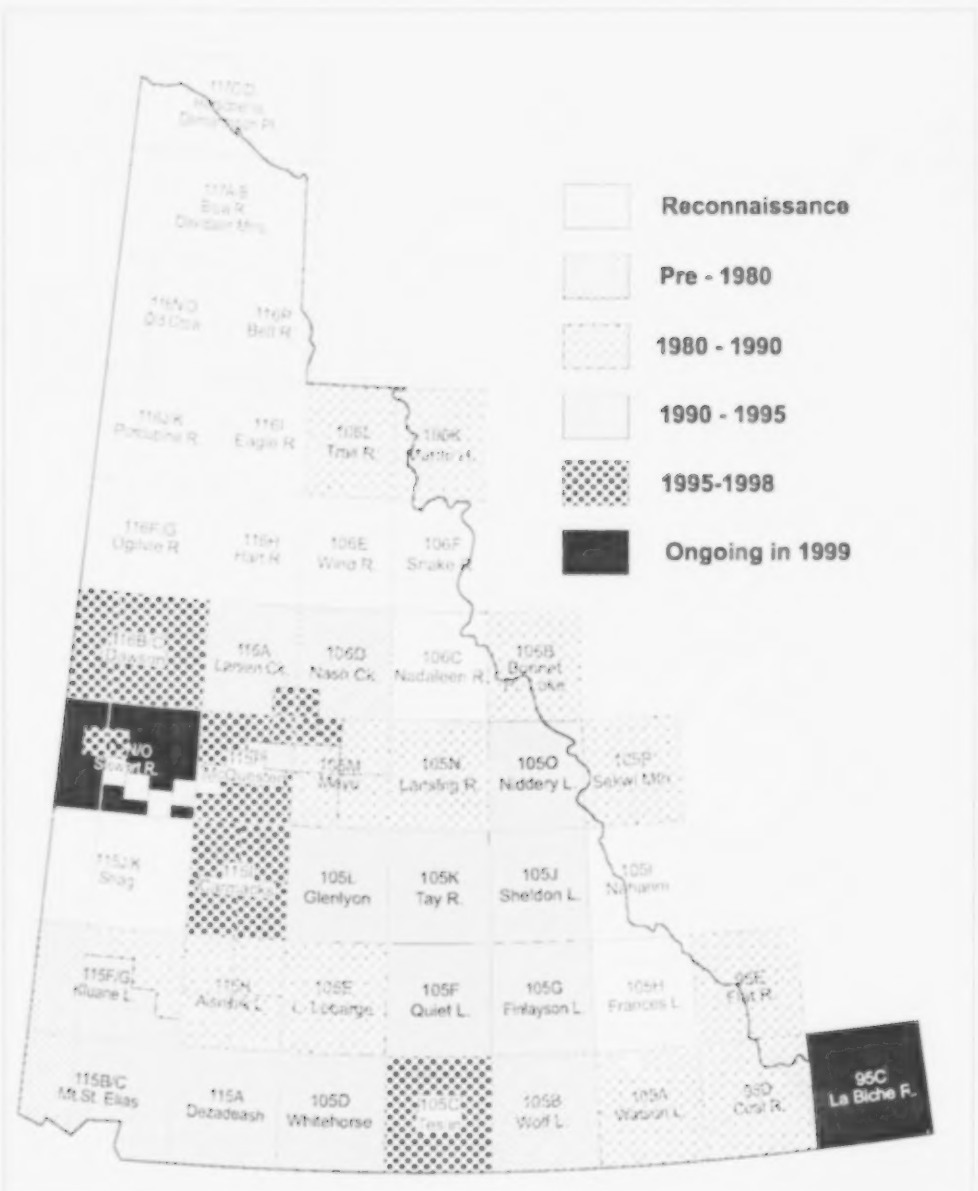


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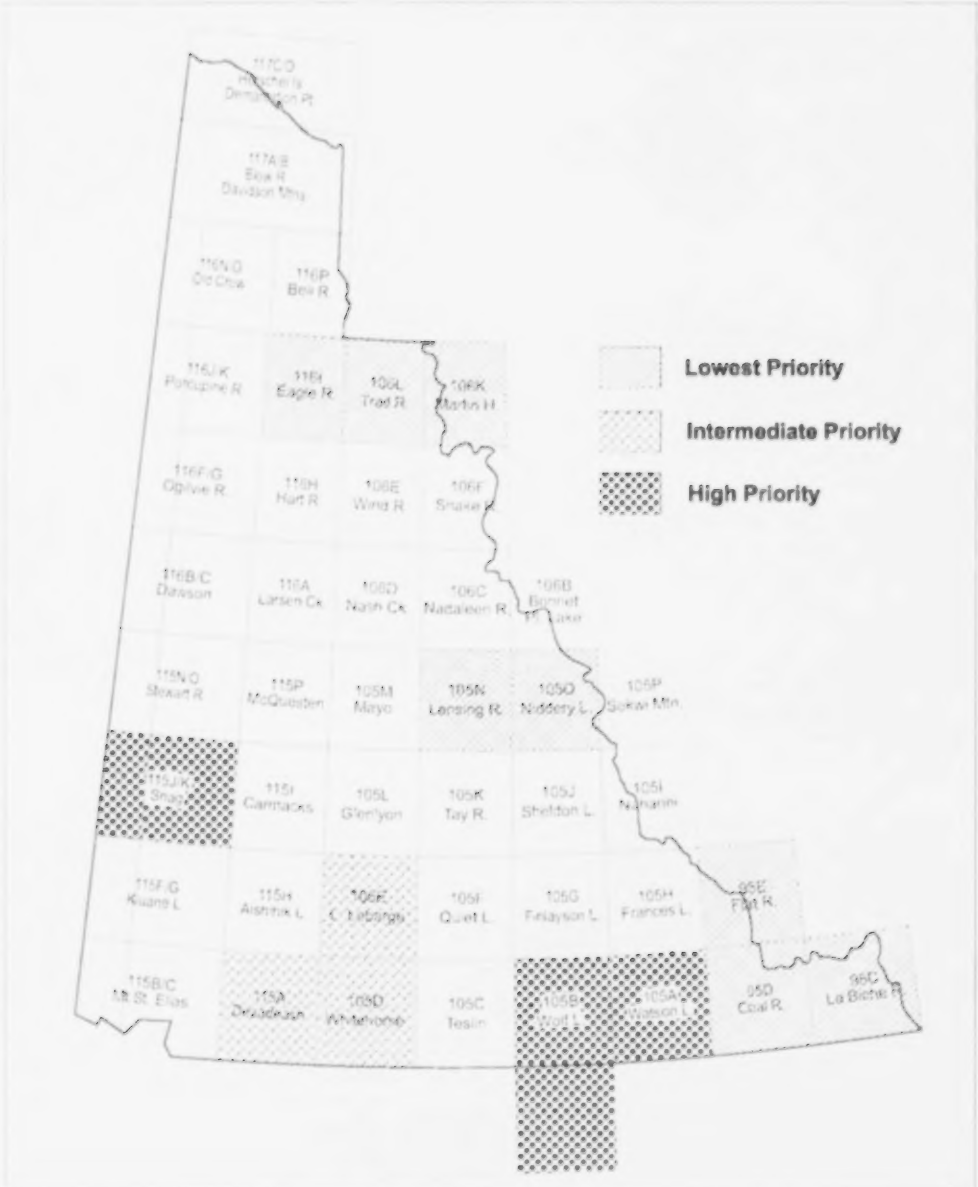


***Figure 9.*** *Proposed surficial geological mapping*

and pay gravel sampling, bedrock sampling, and standard site descriptions.

### *6. User-friendly Placer Products*

There is a continual need for user friendly, simplified products for use by the schools, general public, and miners to understand controls on the distribution of placer deposits in the Yukon. These products could be a series of 'placermat' posters that summarize in a simple and graphic way the occurrence of favourable geomorphic and geologic settings for placers on both a regional scale and a site specific scale.

Models include the Mayo Placer Project pamphlet released by the YGP (but a cheaper and more easily produced plain colour copy produced in house); the compact version of Craig Hart's Tombstone Suite mineral occurrences poster; and a smaller version on plain paper of Grant Lowey's poster summary of the White Channel. Other timely publications would include bulletins and YEG papers for more technical presentations, open file reports and maps for basic data, and customized printouts of a searchable Placer MINFILE Database.

# MINERAL DEPOSIT STUDIES, GEOPHYSICAL SURVEYS AND GEOCHEMICAL SURVEYS

## OBJECTIVES

- Stimulate mineral exploration
- Support geological mapping
- Provide environmental/baseline data
- Archival information

## MINERAL DEPOSIT STUDIES

The four tenets outlined in the Marsh Lake Document regarding the direction of mineral deposit studies by government geologists are supported. They are:

1. District scale metallogenic studies are preferred to deposit specific studies.
2. Multidisciplinary studies involving university researchers, students, industry, MDRU, etc. are encouraged for increased efficiency and the benefit of collaboration.
3. Deposit specific geological information should be acquired from the private sector and placed in the public domain (i.e., YEG, Yukon MINFILE).
4. Metallogenic syntheses and mineral deposit models are needed.

Prioritized listings of proposed mineral deposit studies were supported but with the recognition that only a couple of these will likely be completed. Table 5 is modified from the Marsh Lake Document with identification of new high priority studies, but otherwise was not reevaluated and remains unchanged. Instead guidance was provided in the form of style, approach and focus of future mineral deposit studies. This is an ambitious 'wish list,' but implementation of several recommendations over the next five years is possible.

The group recognized the merit of undertaking mineral deposit studies in directions not necessarily dictated by current exploration rushes. However, they also perceive the value (economic, political, scientific) of following exploration rushes in order to facilitate and catalyze exploration efforts. The Yukon Geology Program is challenged with urgent and long term demands for foundation and archival information. This information provides building blocks to the Yukon geoscience knowledge base and provides baseline information for a variety of client groups. They proposed a diachronous and balanced approach that responds to current industry demands for new, hot,

***Table 5.*** *Proposed mineral deposit studies (modified from Marsh Lake Document).*

| RANKING | DESCRIPTION |
|---|---|
| **HIGH** | Granite related gold deposits (e.g., Brewery Creek) |
| | Volcanogenic massive sulphide deposits in Yukon Tanana Terrane (e.g., Kudz Ze Kayah) |
| | Geological setting of mineral camps (i.e., Tombstone belt, Keno Hill) with emphasis on structure, possibly in conjunction with geophysics and remote sensing |
| **MEDIUM** | Mesothermal shear zone hosted gold deposits |
| | Wheaton River gold district |
| | Mantos (e.g., Ketza Seagull gold district, Sa Dena Hes zinc lead silver deposit) |
| | Industrial minerals |
| **LOW** | Wernecke Breccias |
| | Porphyry copper gold systems in the Dawson range (e.g., Casino) |
| | Magmatic copper nickel platinum deposits |
| | Tungsten skarns |
| | Coal |
| | Epithermal gold deposits along the Tintina Fault |
| | Copper gold skarns |
| | Mississippi Valley type zinc lead deposits |
| | Blende type epigenetic zinc lead silver deposits |
| | SEDEX nickel deposits |
| | Dimension stone |
| | Jade |
| | Asbestos |
| | Tin |
| | Sedimentary iron formations |
| | Uranium |
| | Rare earth elements |

evolving information, as well as providing foundation and archival information to meet future demands from industry.

The following recommendations address these issues:

***1. 'Hot Play' Geologist***

The group unabashedly supported the role of a 'Hot Play Geologist' to stimulate and support current exploration plays. This geologist would be concerned with regional variations in styles and settings of mineralization and would satisfy industry demands for information in an effort to facilitate, catalyze and promote exploration efforts and diminish risk. Efforts would focus on geological aspects that are key to mineral deposit formation with assistance from industry, university researchers and a 'Key Correlation Geologist.'

Ideally focused early in a play, this position would benefit from flexibility and the ability to take advantage of opportunities (drilling, discoveries, field trips, etc.). Goals would be short term, high profile and in the public domain. Information dissemination would be through talks, abstracts, posters, short courses, field trips, etc. The idea is to promote hot new Yukon results and syntheses by presenting information 'outside'). Expectations for products include Yukon MINFILE updates and Yukon Exploration and Geology papers. Longer term goals could include contributions to Society of Economic Geologists Newsletter and Canadian Journal of Earth Sciences, etc., and the development and promotion of regional and deposit specific models. The focus of the position would be reviewed annually.

***2. 'Key Correlation' Geologist***

Operating in conjunction with the 'Hot Play' Geologist, this position would undertake targeted investigations to support exploration plays. This could require studying specific plutonic suites, stratigraphic definition of ore bearing horizons, lithogeochemistry, geochronology or structural studies of ore deposits. These studies would be more data intensive and would benefit from collaboration with geophysical and geochemical studies. We envisage a two- to four year time frame with contributions to Yukon Exploration and Geology papers, Bulletins and Open Files.

*Priorities*

Three 'hot topics' that could benefit from additional support were:

- Granite related gold deposits
- Yukon Tanana Terrane volcanogenic massive sulphide deposits, NATMAP
- Structural geology of camps, i.e., Tombstone Belt, in collaboration with geophysics and remote sensing

They are the high priority studies of Table 5.

***3. Deposit Specific Studies***

Industry demands deposit specific geological information in order to develop its own models and guide exploration efforts. However, intensive government involvement in deposit specific studies leads to perceptions that too much interest is being directed towards one player's property. In order to prevent this perception, the Yukon Geology Program is encouraged to support these studies through graduate students, with industry input where possible. Efforts should be made to get the information into the public domain by oral and poster presentations, Yukon Exploration and Geology papers and Yukon MINFILE updates. Industry contributions to Yukon Exploration and Geology are also encouraged.

***4. Yukon MINFILE***

The usefulness of Yukon MINFILE has diminished over the past several years as a result of inadequate resources to enter an increasing backlog of new information. The need to update Yukon MINFILE is immediate and urgent. Current efforts should concentrate in the direction of maximum benefit, i.e., 'hot play' areas.

***5. Yukon 'Deposit Type' Bulletins***

Compilation reports such as 'SEDEX Deposits of Yukon,' 'Copper Deposits of Yukon,' etc. should be a long term goal of the YGP. These bulletins can provide explorationists who are unfamiliar with the Yukon, with the first steps towards a new exploration plan. These bulletins potentially require a significant amount of time. As a result, we recommend that these bulletins take advantage of the availability of potential contractors such as retired Geological Survey of Canada, industry or university experts. This process provides efficiency and increased stature to the report, and allows government geologists to concentrate on field based projects. However, a drawback to this approach is the money required to hire a contractor is significantly greater than that required to carry out the work 'in house' and the money would come out of field budgets.

***6. Archival***

We recognize the need to compile and archive data from defunct mines and camps, and a short window of opportunity may exist to take advantage of a situation before data and experts are lost. As a result, we support the Anvil Range project and would similarly support a similar project in the Keno Hill camp.

***7. Regional Metallogeny***

Compilations are in demand and provide a good introductory handshake to companies considering exploring in the Yukon. This could be included as another layer in the Yukon Digital Geology CD.

***8. Databases and Digital Products***

Compared to the urgency of completing updates to Yukon MINFILE, other digital products hold little priority. However, the Yukon Geology Program should look to the British Columbia model of 'The Map Place' as a goal. Web site features are appreciated. With increasing tendency towards digital and web-based products, work stations should be provided for those lacking hardware. Remote Sensing is recognized as a valuable exploration and mapping tool and the loss of access to this tool in Whitehorse is lamented. Its increased use by government geologists is encouraged as a mechanism to re-establish access.

***9. Development of Yukon Deposit Models***

Modify existing BC models to fit the Yukon and include Yukon examples. Also add new Yukon specific models which may be absent. There may be opportunities to make the modifications as part of Mineral Resource Assessments.

***10. Mineral Resource Assessments***

Resource Assessments are increasingly viewed as requiring additional and competing geoscience resources. Large scale compilations and metallogenic maps compiled for Resource Assessments should be produced as products suitable for usage by other clients. The production of derivative products will not only be useful but will cast the MRA's in a more favourable light.

***11. METMAP***

Mineral Resource Assessments should, as a short term goal, update Yukon MINFILE maps to 1:250 000 metallogenic maps; and as a long term goal, work towards the production of a Yukon Metallogenic map.

*A final word*

Greater initiatives should be made in the area of public relations and public education with respect to Yukon geology, mineral deposits and mineral exploration.

# GEOCHEMISTRY

***Regional surveys***

New silt surveys in remaining unsurveyed areas remain a priority (Figure 10); however, considering the good coverage over much of the Yukon, equalization of elements and data quality across the existing surveys is considered a more immediate priority. However, the Territory should lobby the GSC to complete Yukon coverage. Higher silt sample density within existing surveys is not a priority: 1:50 000 scale geochemical maps are not the purview of government.

The cost vs. detection limit for unanalyzed elements required for specific exploration targets is recognized as a problem (i.e., Te, Bi). Similarly, the added costs required for non-destructive methods (INAA) are recognized. However, support for additional elements that are specific to HOT exploration models is encouraged – specifically, analysis for Bi W Te in western Yukon.

Development of regional geochemical atlases and derivative products ('beach ball plots') is encouraged. Interpretive studies of regional geochemical coverage in the Yukon have never been done.

***Exploration geochemistry***

The role that the Yukon Geology Program plays in the development of geochemical exploration methods is controversial since these projects are very demanding and resources are limited. However, it is recognized that till geochemistry has been developed to the point of useful application.

***Till geochemistry***

It is suggested that regional till surveys be conducted over areas with high mineral potential, thick till coverage and few mineral claims. Surveys should be combined with surficial studies to assist in interpretation. We recommend regional scale projects (4 sheets, 2 year program, 140 samples per sheet) utilizing student assistants. The following regions are suggested:

1. Finlayson Lake area
2. Keno Hill
3. Along the Tintina Trench
4. Southern Selwyn Basin

***Orientation/case studies***

Orientation and case study surveys are useful in providing data about background, threshold, size fractions, etc. over known deposit types. However, these surveys are expensive and person-power intensive and are therefore not highly recommended except in situations with extensive company support and graduate student involvement. Student involvement on a specific deposit is cost effective and avoids the apparent conflict of government providing beneficial information for the use of a single company.

Suggested studies include:

- Stream sediments and fine fraction gold characterization, as indicated in the Marsh Lake report
- Heavy mineral concentrate studies as indicated in Marsh Lake report. Establish guidelines for sampling and analysis, compile existing data, set up database
- Placer Lode source studies
- Enzyme Leach, MMI
- Water surveys

- Biogeochemistry
- Lithogeochemistry is supported but only with collaborative studies, not as a stand alone study.

All geochemical data releases should be supported with an associated interpretive report. Ideally, a short course dealing with the process, data and interpretations should be given to promote the results and explain the applicability to client groups, particularly when new technology is involved.

## GEOPHYSICS

Geophysical surveys are recognized as a luxury item within a small geological survey. It is suggested that expenditures do not exceed a small part of (5%) of the total YGP budget.

### *Regional aeromagnetic surveys*

Expenditures by the Yukon Geology Program to regional aeromagnetic surveys is not encouraged although the Geological

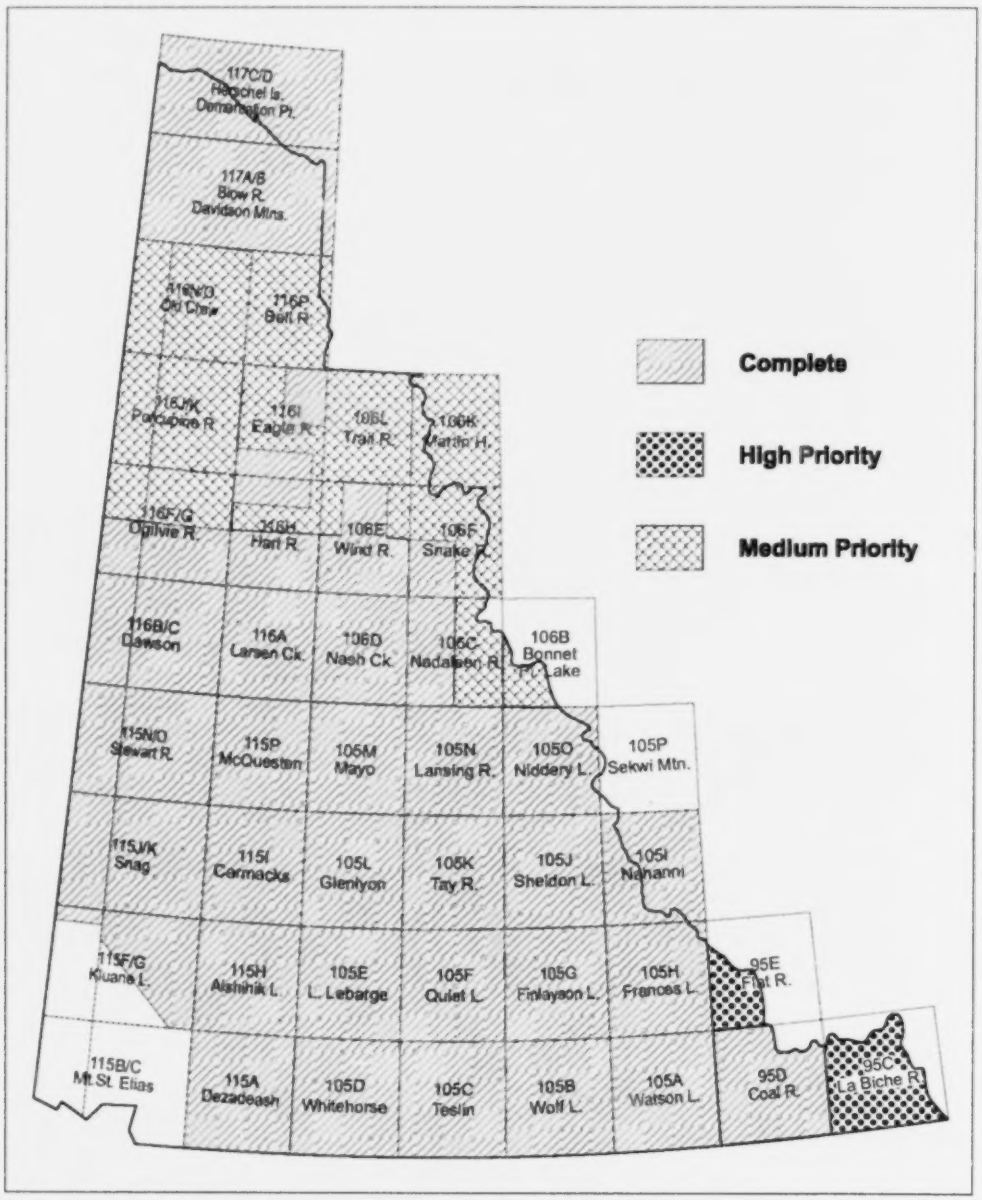


***Figure 10.*** *Regional geochemical surveys.*

Survey of Canada should be encouraged to set a timetable for completion of the Yukon (Figure 11). An 800 m line spacing (~$180k/1:250 000 scale sheet) should be maintained as wider spacing has limited usefulness for interpretation of surface geology and almost none in an exploration sense.

The Geological Survey of Canada should be encouraged to consider the Nahanni sheet as a priority. The map area is underlain by mid-Cretaceous granitoids intruding miogeoclinal strata. Unmapped magnetic hornfels zones, which are currently gold exploration targets, may be identified in the survey.

Additional pressure can be exerted from the Government of NWT as the map sheet straddles the border.

Unsurveyed blocks in Wind River, Nash Creek, Snake River, Nadaleen River and Bonnet Plume Lake (106B,C,D,E,F) are identified as a priority in light of the high mineral potential of Proterozoic strata. Should any of these regions become the focus of geological mapping efforts, they would benefit from aeromagnetic surveys and should then be considered highest priority.

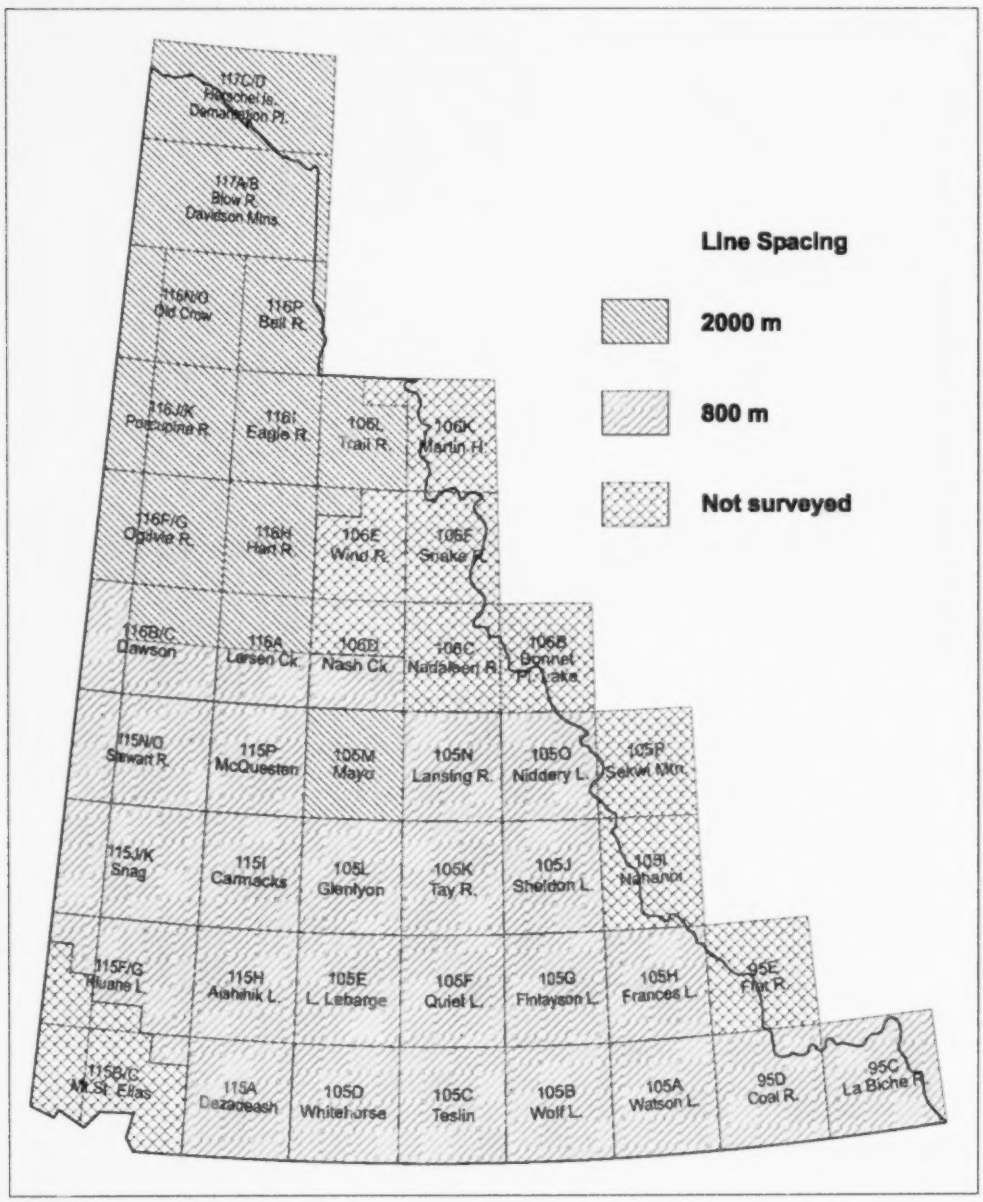


***Figure 11.*** *Aeromagnetic coverage.*

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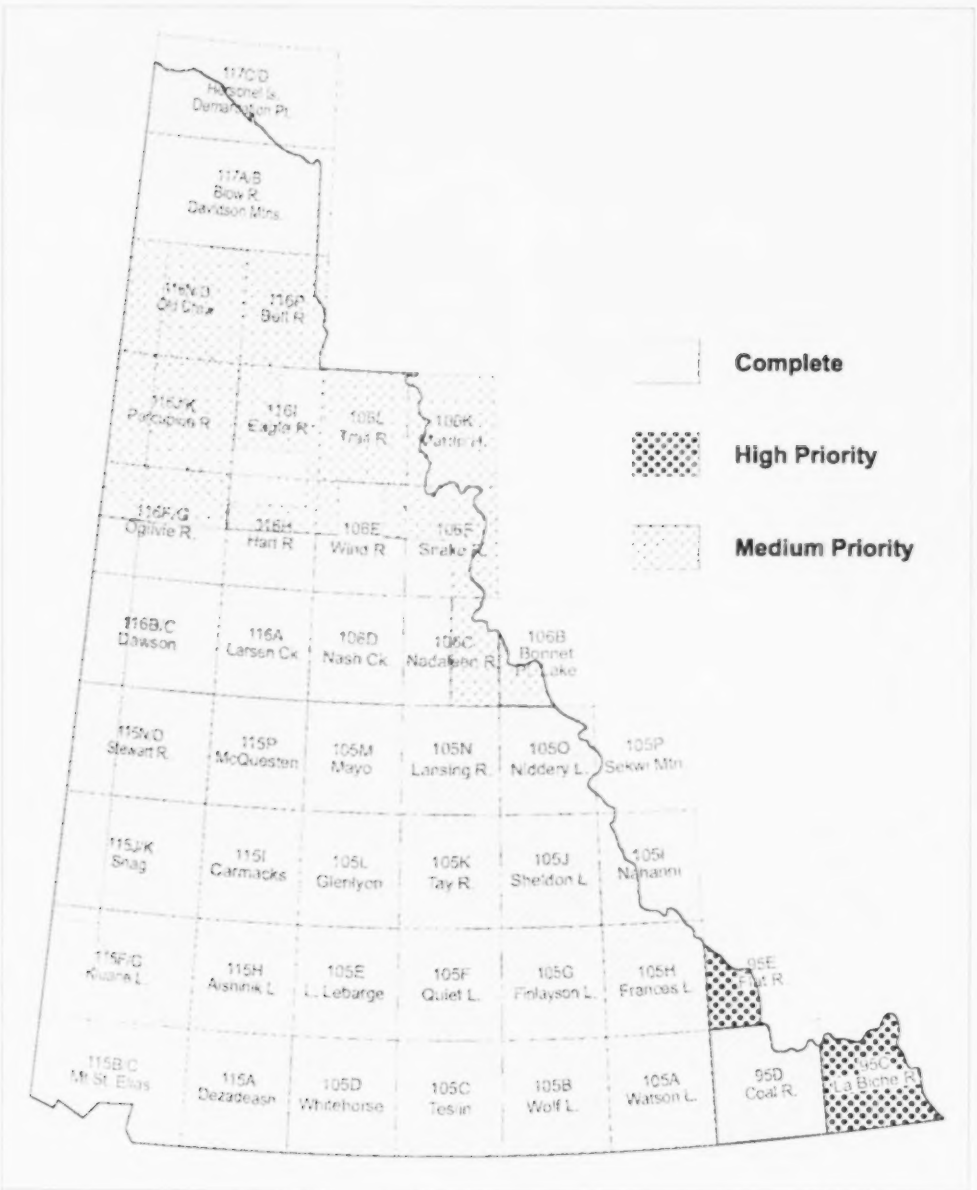


***Figure 10.*** *Regional geochemical surveys*

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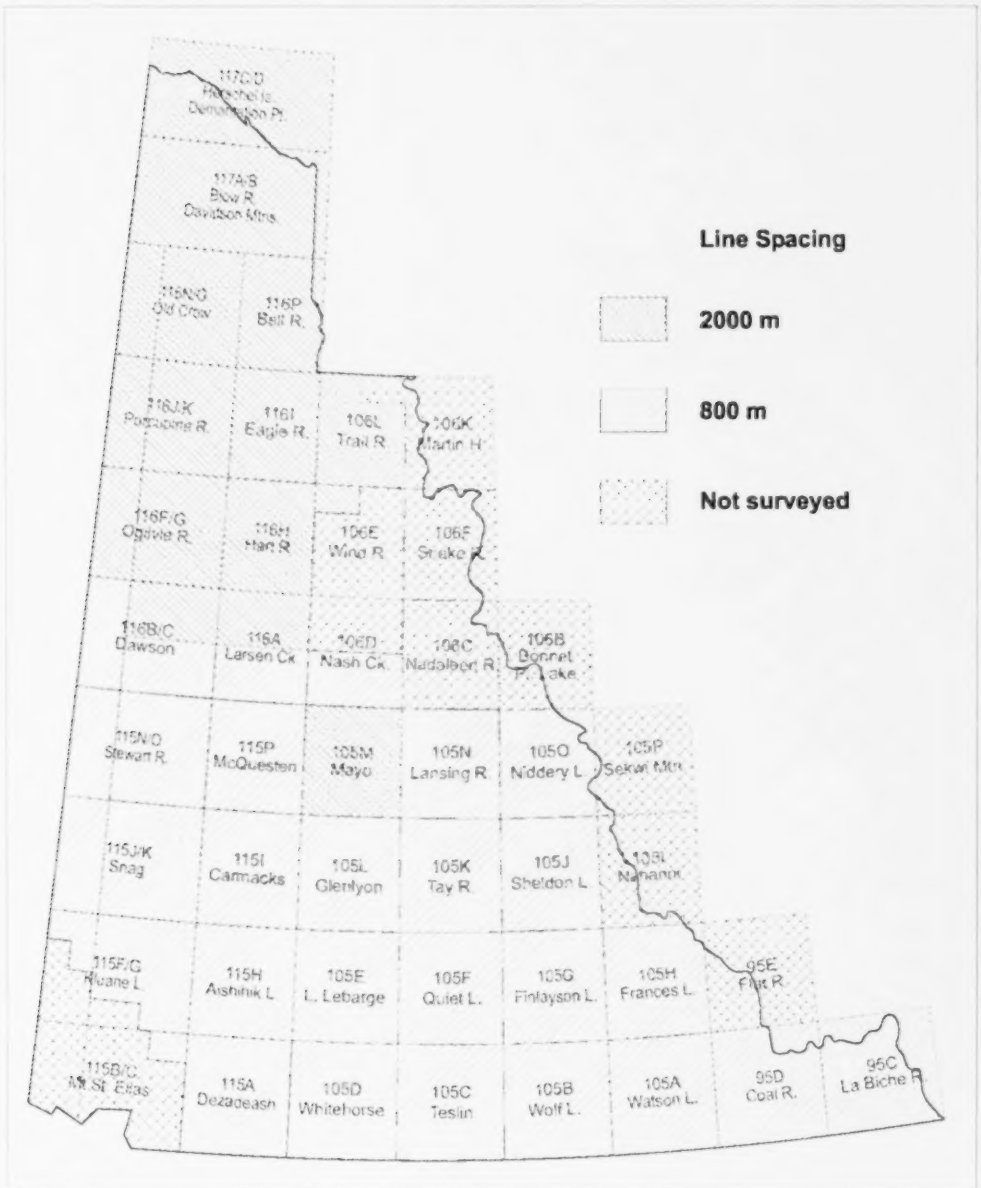


*Figure 11.*
*Aeromagnetic coverage.*

### *Detailed surveys*

Detailed, topographically draped multi parameter airborne surveys are recognized as having benefits for geological mapping and mineral exploration, particularly in regions with poor outcrop.

Magnetic surveys with gamma rays are preferred. Electromagnetic (EM), in addition to magnetometer and gamma ray surveys, are considered to be too expensive, unless industry supported. EM may be beneficial for certain deposit types and cost effective without gamma rays. Each 1:50 000 sheet requires approximately 1800 line kilometres at 500 m spacing for a total cost of $50,000 80,000 per sheet. EM almost doubles the cost.

Stewart River map area remains the highest priority target area. Mapping should not be undertaken without geophysical support, but the Geological Survey of Canada is not capable of financing more than one sheet per year. The NATMAP geological mapping initiative of the Stewart River area should provide additional support for geophysical surveys in support of the mapping. Contributions from Yukon Geology Program and Geological Survey of Canada should be either targeted to benefit mapping or should be flown as an across strike transect over the region to provide some coverage of the various geological components.

Consortium partnerships with industry proponents are desirable if regions chosen are based on sound geological reasoning. Confidentiality periods are a drawback. Six month periods are preferred and periods should not exceed twelve months.

Commitments to post acquisition, geological interpretation of the data is necessary. Workshops should be given to promote the results and aid in interpretation.

### *Survey acquisition*

Efforts should be made to acquire existing geophysical surveys. Surveys may require re leveling or processing to meet acceptable standards. Purchased surveys may provide the basis for geological compilations. Existing surveys are known for the Minto Williams Creek and the Sixtymile, Klondike and Teslin Crossing areas.

*Table 6.* Regional survey priorities (modified from Table 7, Marsh Lake Document).

| SURVEY TYPE | PRIORITY ASSESSMENT |
|---|---|
| **Geochemistry** | |
| Standardization of existing regional data | High |
| Develop Yukon wide atlas from existing NGR data | High |
| Till geochemical surveys in selected areas | Medium |
| Complete RGS coverage of the Yukon | Medium |
| NGR re analysis for Bi W Te (1:250 000 scale) | Medium |
| **Orientation Studies** | |
| Placer/lode source studies | Medium |
| Fine fraction gold analysis (1:50 000 scale) | Low |
| Soil and dirt geochemistry and mapping (1:50 000 scale) | Low |
| Fine fraction platinum analyses (1:50 000 scale) | Low |
| Lithogeochemistry (collaborative) (1:50 000 scale) | Low |
| Enzyme leach | Low |
| Heavy mineral analysis | Low |
| Water | Low |
| Biogeochemistry | Low |
| **Geophysics** | |
| Aeromagnetic survey of Nahanni map area (NTS 105I; 1:250 000 scale) | High |
| Airborne gamma ray/mag/VLF (1:50 000 scale) in Stewart River Map area (115N/O) | High |
| Regional aeromagnetic surveys (1:250 000 scale) | Medium |
| Education and training for users of geophysical data | High |
| Acquire industry data | High |
| Interpret existing geophysical data | High |
| Gravity along Lithoprobe lines | Medium |
| Yukon gamma ray calibration | Low |
| **Other** | |
| Make better use of existing remote sensing data | Medium |
| Public access to GIS work station | Medium |

## REMOTE SENSING

The accessibility of remote sensing tools by the local (Yukon) geoscience community continues to be an issue. Increased use of remote sensing data by Yukon Geology Program staff is encouraged to provide accessible materials to prospectors, etc. NATMAP proponents are encouraged to collaborate with Canada Centre for Remote Sensing (CCRS) to establish usefulness in context with mapping and geophysics.

# CONCLUSIONS AND RECOMMENDATIONS

Carl Schulze commented that the workshop was well organized, productive, focused on economic interests, and set standards for future planning. Mike McDougall commented on how far Yukon geology has progressed over the past ten years and how the meeting was a positive step that showed how cross fertilization might help the placer industry to develop. Dennis Ouelette remarked on how beneficial continuity of purpose and participants has been for both planning and undertaking Yukon geoscience. Also noted was how much Yukon geology has benefited from the extensive collaboration and goodwill demonstrated by the YTG, DIAND, the GSC and universities. Consensus was clear on several issues.

The ever increasing amount of information means that traditional maps and reports are not enough. Information must be made more accessible through innovative new digital products such as map compilations and databases, and new distribution mechanisms such as the Internet. With land management and environmental regulation becoming increasingly complex, the ability of clients to easily integrate geological data with other geographical data must be developed.

Geoscience is becoming complex and sophisticated. Increasingly, advances will be made through multidisciplinary projects such as NATMAP, and continual collaboration among the different agencies undertaking geoscience in the Yukon is essential.

Demands for geological information no longer come only from the mining and exploration industry. Other areas include: a Yukon administered oil and gas industry; land management issues through the land claims process, the Yukon Protected Areas Strategy, and the Development Assessment Process; tourism and public education; and environmental issues such as groundwater, and terrane hazards. The workshop demonstrated that the amount of work that needs to be done far exceeds the capacity of government agencies. The broadening of the client base will place even more demands on these resources.

As chair of the Yukon Geology Technical Liaison Committee, Gerry Carlson commented that the workshop was a needs assessment, not a work plan. He proposed development of a five year plan for the Yukon Geology Program followed by an annual 'audit' to assess progress and adjust the plan to new needs and realities. He also suggested that a short report be submitted annually to the Workshop participants.